Nature Magazine

NOVEMBER
1955
VOLUME 48 NUMBER 9
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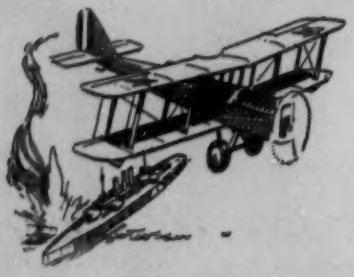

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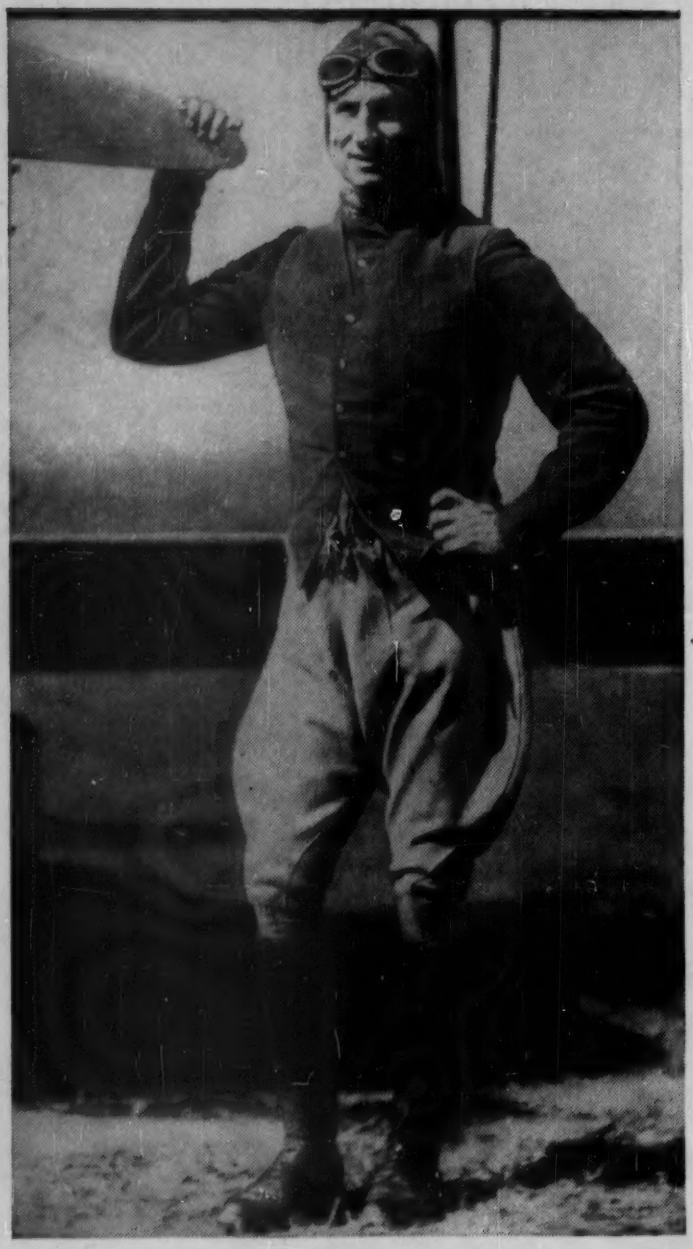

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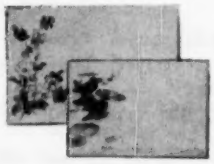

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NOVEMBER, 1955 VOL. 48, NO. 9

Published by the **AMERICAN NATURE ASSOCIATION** to stimulate public interest in every phase of nature and the out-of-doors, and devoted to the practical conservation of the great natural resources of America

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Nature Magazine past and present, is indexed in The Reader's Guide in your public library.

Great True Adventures

Selected by Lowell Thomas. New York. 1955. Hawthorn Books. 400 pages. $5.00.

Twenty-nine great adventures have been chosen for this anthology by Lowell Thomas, who has done some adventuring himself. The selections range from Joshua's mission to Jericho, as related in Holy Scripture, to Thor Heyerdahl's epic trip by trans-Pacific raft. The anthologist provides brief introductions to each adventure, many of which are taken from books.

Animal Clothing

By George F. Mason. New York. 1955. William Morrow and Company. 94 pages. Illustrated by the author. $2.00.

In this little book the author discusses in popular terms the different protective coverings provided all living creatures except humans. Thus his book includes the fur of mammals, the feathers of birds, the skin of such creatures as frogs, the armor of turtles and crustaceans, the scales of fishes, the chitin of insects. This is a companion to his earlier excellent books on tools, weapons, sounds, homes and tracks of animals, which together make up a valuable little library.

The Beast that Walks Like Man

By Harold McCracken. New York. 1955. Hanover House. 319 pages. Illustrated. $4.50.

"No other animal has been more respected and feared through all the generations of red men and white men who have known him; and none has been subjected to such an intensive attrition of extermination," writes Harold McCracken in a foreword to his valuable and fascinating story of the grizzly bear in America. He set himself the task of presenting a "chronology of the best of all information relating to the grizzly bears, from the earliest times." Into any such story must be woven, necessarily, much lore and legend, as well as fact. The great bear was a figure in the settlement of the West, too, with many species called grizzly playing their part. The status of the grizzly today is, of course, one of a greatly reduced mammal, but just how many individuals, and of what species, remain is largely a matter of guess. The bear should be protected as a part of our fauna, and Mr. McCracken's splendid book should help in achieving such solicitude.

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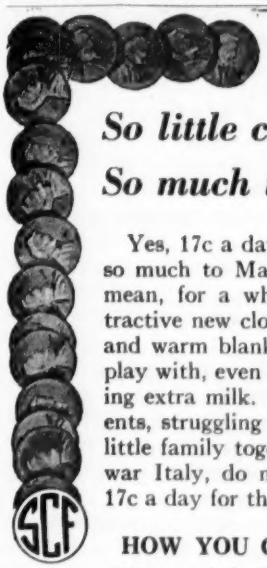

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NM-2

Nature IN PRINT

By HOWARD ZAHNISER

WELL OF NATURE

(One of Fifty Poems)

Outside there is a well
Free to all for the drinking.
No earthly man can tell
How deep it is. Our thinking

Dries up whenever we look
Into its soundless pool;
For it there is no book
Or any kind of rule.

But there a man can drink
More than his mind can follow,
Until his senses shrink
And he can not swallow,

Until his eyes grow blurred
With helpless wonder,
And the unspoken word
Tears his spirit asunder.

Paul H. Oehser

Paul Oehser's Poems

POETRY SINGS ITS WAY through more of our living than we realize, or readily admit, for the long days of prose seem to make up most of our years in these times of mechanical miracles and exploratory science. When the love of Nature swells within us and bursts into expression, how likely we are, not to seek to communicate our love, but rather to converse on the importance of forests, and wildlife, and all the outdoors, their importance to our way of life, exchanging rationalizations of sentiments that are thus communicated only by implication and inference. Excited by facts, delighting too little in fancy, we honor ecologists—as well we should—but neglect our poets. Intrigued with interrelationships, we readily analyze and marvel, but seldom synthesize and worship. With all our illumination we so frequently miss seeing life whole, our very particular eagerness to be specific so often eclipsing the inspiration and the ecstacy of sensing the universal. Yet not always nor all of us! Poetry is still a part of our language and literature. Poets are still among us, still heartily singing to themselves and to each other, still heard ever and anon by all of us. And one of them is Paul Oehser.

Urging the cause of conservation, pleading for the preservation of wilderness, I have been (and am) on a journey to learn—and try to show—how it all makes sense, good sound sense, fitting into the essential prose of our way of life. Returning from this journey, riding in a fast-moving streamliner train of cars, looking out across wide expanses of landscape to high mountains, I read "A Poem for Patriots," among Mr. Oehser's *Fifty Poems*, and feel strengthened and upheld.

Look out to the far blue haze clinging
  to mile
On mile of mountains, until the
  throat grows tight.
Look out across the great sea of
  Kansas soil
Where bread is garnered for a sad
  world of mouths,
Harvest of sun and toil, beautiful
  as song;
Stand where the Colorado cuts earth
  in two
And turn away, speechless and
  unbelieving;
Follow Shoshone Canyon to the
  Yellowstone.
Gaze out over the wilderness, lose
  the breath
In the dizzy ice-peaks, fill up the
  unused lungs
With the fragrance of a million
  million pines,
Lay the bare palms on the unscalable
  wall,

He sings, and assures me it is sweet and proper, *dulce et decorum*—

To praise whatever land we love,
  to borrow
Hymns from the hills and solid
  prayers from the plains.

And I wish that all with whom I have reasoned—and perhaps argued a bit—and I myself, could have had our conversations and conferences suffused (or more consciously suffused) with the poetry of our positions.

In another of these *Fifty Poems*, "November," Mr. Oehser laments with a compassion for hunted creatures—

Now is the time of all Novembers,
When the great thorn of fear pierces
  through the frail shield
Of the world's loveliness.

I ponder the mystery of predation, remember a sympathy for all predators that includes a sense of the nobility of certain sportsmen, too, and recall many earnest and reasonable discussions of wildlife management that stress the importance of a harvest by hunters. Yet I appreciate the more deeply this poem that touches life tenderly and renews reverence and humility.

These *Fifty Poems* are a first volume of poetry that is in part our poet's celebration of his own fiftieth anniversary. It is a comment on our times that the poems although so excellent are so few, that we have waited for them so long, and that even so the poet has had to publish them himself. An editor for the last half of his fifty years, and for many of them the editor-in-chief of the Smithsonian Institution, Mr. Oehser in a preface written with good-humored candor and humility calls poetry a sideline, one that he has pursued "faithfully and pleasurably," and the subjects he has sung in such poetic circumstances are interesting to note—characterizing himself and also the poetry of his time. There is little that is urban or mechanical. (One sonnet lets a city slumber in the rain. Another poem grows in a museum, but it takes its life from an Indian visiting there.) For the most part the poems are reminiscent of rural and village influences, reflections of people with distinctive character honored by the poet, and

——————solemn chants,
  As beauty yields to war and
    death and circumstance.

The volume certainly belongs with our poetry of Nature. The first of its five numbered but otherwise unlabeled groups of poems, like its opening selection, "A Poem for Patriots," tells of a love for the land, and its verses are beautiful with nostalgia. In a second group, open-

ing with the "November" lamentation for "fiery fears in tiny brains," our poet expresses the poignancy of the change that comes over all, especially through the incredible disturbances of human beings.

For I am but a man, and hence
Confounded by impermanence.

"The Forest" states as starkly as beautiful verse can the hazard of man's enmity with his environment, and the impertinence of his destructiveness.

Yet, from the patient seed, the mother,
Will come once more the forest's birth,
When the last man has slain his brother,
And himself has perished from the earth.

The bleached bones will yield up their lime
To the leaf; the gun and axe will rust.
Earth will again be green, and time
Will flower from the wind and man's dead dust.

Man's despoliation of Nature and his self-destruction merge also in "Arlington, March 21," and the thought of "the green earth again awakening" helps one to forget "the hate that kills and the world's lost hope."

Here, friend, upon this fine sweep of hill,
Where I have seen the insistent honeysuckle
Weave on the ground a fragrant cover, and then climb until
The locust saplings would almost buckle
Over; where second-growth once ramped wild and free—
Oak and tulip and sweetgum and sassafras;
Children of the trees of General Lee—
Where the field mice hid themselves in the unkempt grass;
And the song sparrows came every year to raise
Their speckled quintuplets, unafraid,
And joyful; and the bobwhites found secret ways
Through the thick, protected shade;
And the chipmunks played along the cemetery wall—
Here, now, they have cleared away this little wilderness,
And planted a lean lawn.

A faith, a cautious hope, a plaintive supplication are also sung, notably in "Hymn to Morning:"

This is the golden hour,
The shining tide;
This is the budding flower
Opening wide;

God of the Day, beware!
Apply thy touch,
Keep pure the virgin air,
Attend thy watch;

Let not the morn be done
Before the noon,
Nor the bright waning sun
Go down too soon.

As in the volume's illustrations by Grace E. Oehser, the graphic areas on the white page vibrate into habitude or tree or beast, so these poems, sounding out of a poet's half-century, become pulsations of our own and the prose of our appreciations of Nature is punctuated with a singing. Perhaps it is true that such verses are written by a poet for his own self first, yet surely they are sung also to be heard, published to be read. We all are like the poet himself remembering, in one of his best poems, his boyhood experience with "The Man Who Talked to the Birds" but realizing at last that—

He was talking to me when he talked
to his dog and his horse;
He was talking to me when he talked
to the birds,
Else how would I have remembered
his words so long?
Always remembered his words.

Fifty Poems. By Paul H. Oehser. Washington 4, D.C. Box 855: Sherwood House, 1954. X + 60 pages (5½ by 8¼ in.), with 4 illustrations by Grace E. Oehser. $2.50.

Seashores

By Herbert S. Zim and Lester Ingle. New York. 1955. Simon and Schuster. 160 pages. Illustrated by Dorothea and Sy Barlow. $1.00 paper; $1.95 cloth.

This is the eighth book in the excellent "Golden Nature Guide" series. It is devoted to shells, sea plants, shore birds, and other natural features of the American coasts. That takes in a lot of territory, both so far as natural history subjects are concerned and with respect to geography. However, the illustrations, in full color, cover 475 marine subjects and this most recent addition to the guide series is an excellent introduction to the fascinations of seashore.

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Reviews

Seeing America's Wildlife

By Devereux Butcher. Washington, D.C. 1955. Defenders of Furbearers (2140 P. St., N.W.) 348 pages. Illustrated. Paper, $2.50; cloth, $5.00.

This beautiful book has no counterpart. It presents, in text and in an outstanding collection of pictures, valuable information about one of our great natural resources—the relatively new system of National Wildlife Refuges. Published by The Devin-Adair Company, New York, it has been prepared under the auspices of Defenders of Furbearers, of which organization Mr. Butcher is secretary.

The refuge system is taking an increasingly important place in the recreational picture in the United States. These areas attract many visitors annually, a large percentage of whom come to see the wildlife in habitat and unrestrained. It is to such visitors that Mr. Butcher directs his fine book. By way of introduction he draws a word picture of some of unspoiled America. Then he discusses concisely the history of wildlife conservation, protection and management, as well as the ethics of "killing for fun."

Having set forth his view of wildlife and its protection, the author proceeds to description of some forty refuges. Information provided indicates the species to be found, the significance of the refuge, the way in which it may be visited, and related data. Briefer description is provided for the other refuge areas —mostly small ones—, and a useful bibliography is included.

Wildlife and outdoor enthusiasts are indebted to Mr. Butcher for this pioneering work. It is plain that he has painstakingly assembled the splendid pictures that illustrate the book, including many of his own taking. The result is truly an achievement in wildlife and conservation literature.

Bulletins

"Birds of New Zealand" by Alfred M. Bailey is No. 11 in the Museum Pictorial series of the Denver Museum of Natural History. This 116-page popular discussion of the avifauna of both North Island and South Island is beautifully illustrated.

"Your Pet Dog" by Gabrielle E. Forbush is a 24-page booklet on the care of a dog pet. Available from All-Pets Books, Inc., Fond du Lac, Wisconsin, for 25 cents.

"Red Foxes and a Declining Prey Population" by Thomas G. Scott and Willard D. Klimstra is a 124-page monograph published by Southern Illinois University, Carbondale, Illinois, at $2.00. Of special interest to wildlife students.

"Popular Finches" by George W. Noreen is a 24-page booklet discussing a number of species of these cage birds, their breeding and care. Published by All-Pets Books, Inc., Fond du Lac, Wisconsin, at 35 cents.

"Pet Alligators" by Carl F. Kauffeld is a 24-page booklet that should ease the lot of hatchling young alligators frequently shipped as pets from Florida. Available from All-Pets Books, Inc., Fond du Lac, Wisconsin, for 35 cents.

"Your Pet Cockatiel" by Alice L. Sadler is a 24-page booklet about this cage bird. Published by All-Pets Books, Inc., Fond du Lac, Wisconsin, at 35 cents.

"An Evaluation of the Red Fox" by Thomas G. Scott is a 16-page bulletin on the situation of the red fox. Published as Biological Notes No. 35, Natural History Survey Division, State of Illinois, Urbana, Illinois.

"The Saratoga Spittlebug," "California Five-Spined Engraver Beetle," and "Douglas-Fir Beetle" are, respectively, Forest Pest Leaflets Nos. 3, 4 and 5 of the U. S. Forest Service. These four-page leaflets are available at five cents each from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

"National Forests of the Southern Region" is a report of progress in this area from 1934 to 1954, and is published by Region 8 of the U. S. Forest Service in Atlanta.

"Native Land" is a 48-page, illustrated booklet published by the National Association of Manufacturers, 2 East 48th Street, New York 17, N.Y., to set forth our common stake in the conservation of our renewable natural resources. Ten cents a copy.

"Knowing and Controlling Insects" is a 4-H Club entomology manual published as Circular 746 of the College of Agriculture, University of Illinois, Urbana.

"Natural Resources and Conservation" is a 35-page pamphlet, being a study committee report submitted to the Commission on Intergovernmental Relations. Copy available at 20 cents from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

"The Chemical Industry" is a 148-page, paper-bound booklet presenting factual data with respect to this industry. There is a Teacher's Guide, also. Published by the Manufacturing Chemists' Association, Cafritz Building, 1625 Eye Street, N.W., Washington 6, D.C., for one dollar.

"Graduate Theses, 1944-1954" is a compilation by Genevieve L. Reidy of the title and subject matter of graduate theses at the College of Forestry, State University of New York, Syracuse.

"The Hurricane" by I. R. Tannehill is a new printing of the bulletin about hurricanes and is available for ten cents from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C.

"How Can Citizens Help Their Schools?" is a 24-page booklet published by the National Citizens Commission for the Public Schools, 2 West 45th Street, N.Y. 36, N.Y.

"Handbook on Pests and Diseases" is a 96-page booklet on the control of pests and diseases of ornamental plants and lawns. It is published by the Brooklyn Botanic Garden. Brooklyn 25, N.Y., at one dollar,

"Guide to the Sea Shore at Long Beach Island, New Jersey," is descriptive of this area and its natural history. Available at fifty cents from Schooner Lucy Evelyn, Beach Haven, N.J.

"Conservation Teaching Tips" is a 23-page bulletin prepared by Howard H. Michaud and Prevo L. Whitaker and based on participation of many Indiana teachers in the conservation education project of the National Association of Biology Teachers. Copies available from Dr. Michaud, Department of Forestry, Purdue University, Lafayette, Indiana.

"Michigan Natural Resources Conference" is a 55-page booklet setting forth the findings and recommendations of the conference sponsored by Michigan College of Mining and Technology, Michigan State University of Agriculture and Applied Science and the University of Michigan. Published by Michigan State University, East Lansing, Michigan.

Contents noted

BY THE EDITOR

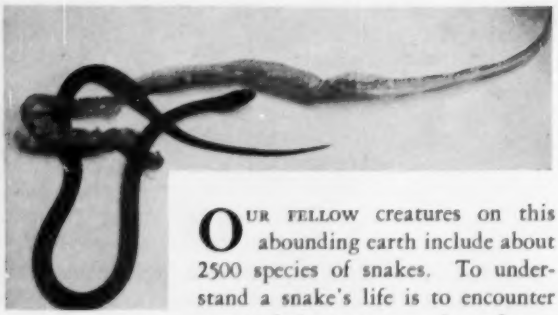
SCHOOLS — YOUR INVESTMENT IN AMERICA is the slogan of American Education Week, observed this year from November 6 to 12. This observance is jointly sponsored by the National Education Association, the American Legion, the United States Office of Education and the National Congress of Parents and Teachers. Certainly our investment in our schools is also an investment in our country, its safety and future strength. The sponsors of American Education Week propose different topics each day of this special week, emphasizing the dividends supplied in return on the school investment in character building, teachers, classrooms, fundamental learning, better living, and a strong Nation. It is proposed that the week end by stressing that this investment is the responsibility of everyone. This last thought, it seems to us, should run through the thinking about our schools every day of the year. We cannot afford to be niggardly in our provision of them or for them, or in training and adequately paying those who teach our children. We are not enthusiatic about weeks devoted to this and that, but if American Education Week will contribute to fulfilling our common responsibilities toward our schools, we are willing to make it an exception.

MORE THAN $80,000,000 IN NATIONAL FOREST REVENUE was paid into the Federal treasury during the fiscal year ending June 30, 1955. This income was derived from sale of timber under the Forest Service's scientific management program, from grazing permits and other land use. To the last penny, the revenue totalled $81,137,294.18, an all-time high. When we read such figures they reemphasize the soundness of the proposal that has been before Congress during the past three or four years. This is legislation that would make available ten percent, or not more than a certain amount, of the income from the National Forests for proper administration of their wildlife and recreational aspects. Recreational use of the forests has grown steadily and far outstripped facilities available, including such basic considerations as sanitation. Provision of adequate funds, through such legislation or direct appropriation would be an investment in the National Forest resource itself. Perhaps the next session of Congress will see the wisdom of increased attention to the recreational problem in the forests.

TWENTY STATES NOW PROTECT MOURNING DOVES. Most recent additions to this Honor Roll have been Minnesota (1947); Montana (1951); Nebraska (1953). Guy Atherton, Director of Conservation Militant, Box 72, St. Paul 2, Minnesota, reports that campaigns to extend protection to the doves are under way in Arizona, California, Illinois, Kansas, Nevada, Pennsylvania and Washington. He emphasizes that it is a question of everlastingly carrying on education and calling public attention to the ridiculousness of shooting these valuable birds for the minute amount of meat they yield. Actually they are shot because they are living targets, and for the fun of it. For those who would like to help, Mr. Atherton will supply, for a dime, two car-window stickers carrying a message "Stop Dove Hunts!" and ten labels for stationery entitled "Facts about the Mourning Dove." This last presents the following facts: "Smaller than a domestic pigeon. Meat 3 ounces. Sacred emblem of peace and life after death. Eats up to 10,000 weed-grass seeds daily. Total hunting season over four months. The only game bird shot while still brooding its (two) young in the nest. Often shot from wires by boys as a target. Estimate 5 cripples for each kill recovered. Hunters increasing 10% a year. Doves losing. Nests often destroyed by wind or predators."

YOUNG PEOPLE FROM TEN NATIONS attended the International Camp for the Study and Protection of Nature this summer on Fehmarn Island in the Baltic Sea. There were fifty-one delegates—whose average age was twenty—to this fifth annual camp under the auspices of the International Union for the Protection of Nature. World conservation problems provided their central theme, and the camp sessions included discussions, lectures, films and a ten-day schedule of field trips. A significant development was the drafting of plans for an International Federation of Youth Camps for the Study and Protection of Nature. This Federation will be inaugurated at the 1956 IUPN camp, which will be held at Grossvenediger, in the Austrian Alps.

EXTINCTION OF THE WHOOPING CRANE loomed as a real possibility when the U.S. Air Force sought permission to carry on night photo-flash bombing maneuvers contiguous to the Aransas National Wildlife Refuge in Texas. There the few more than a score of the remaining birds spend the winter. Such nightly disturbance as proposed would inevitably drive the birds away and to their eventual extirpation. The President of the American Nature Association was quick to register official and public protest. In a few days Canada raised strong opposition, and the U.S. Fish and Wildlife Service declared itself again. At press time it appeared that the threat is averted. R.W.W.



Except during the winter in northern climates, where snakes hibernate, the snake will change its skin on an average of every six weeks.

Myths and misinformation often obscure

What Snakes Are Really Like

By ALAN DEVOE

OUR FELLOW creatures on this abounding earth include about 2500 species of snakes. To understand a snake's life is to encounter some of the most amazing adaptations and specialized gifts in the world of Nature.

A snake never closes its eyes; it has no eyelids. A snake can engulf prey far bigger than its mouth—but it may endure a fast for months without ill effect. Such giant snakes as Asia's pythons are sometimes thirty feet long, thick as a tree, and capable of swallowing a deer. Poisonous snakes like Africa's mambas are so deadly that men have died from a bite in less than one minute. The harmless snakes of our fields and gardens have such odd endowments as a stomach that can digest bones and a yellow eye-lens that gives sharpened vision by filtering out ultraviolet rays.

It is hardly surprising that creatures so curious and startling should be the subject of more myths and misunderstandings than any other under the sun—or under the moon, for many snakes are most active at night. A naturalist must clear away snake myths by the dozen.

It is not true that snakes are "slimy." Their skins are dry and exceptionally clean. No snake has a poisonous sting in its tail. No snake rolls like a hoop, has yellow blood or hypnotizes birds. Mother snakes do not swallow their young to protect them. Snakes' darting, flicking, "wicked-looking" tongues are harmless. Killing a snake will not bring its mate seeking vengeance. It is not true that a mortally injured snake somehow retains life until sundown. It is not true that a horsehair in water ever turns into a snake. It is a myth that snakes suck milk from cows and that snakes are charmed by snake-charmers' music. Snakes are deaf.

This x-ray photograph of a 37-inch king snake that swallowed a 43-inch corn snake, shows the ribs and vertebrae of their bodies.

The real facts about snakes are more remarkable than any fables. Nine-tenths of all species are harmless. Very few have any aggressiveness toward man. By destroying insects, mice and many other pests, they help in the balance of Nature's economy.

Everything about a snake is designed around the key fact that it has no arms or legs. Yet a snake is not at all a primitive or simple being like a worm (to which it is unrelated) but a highly developed, complex one. It breathes by a lung. It has a three-chambered heart. Its internal processes involve an intricate physiology of liver, gall bladder, kidneys. And it must catch prey, defeat or evade enemies, reproduce its race, meet all the problems of living in a world of "accessoried" creatures while confined inside its own elongated skin like a man strait-jacketed and hobbled. It is to meet this unique problem that Nature has given it specialized equipment

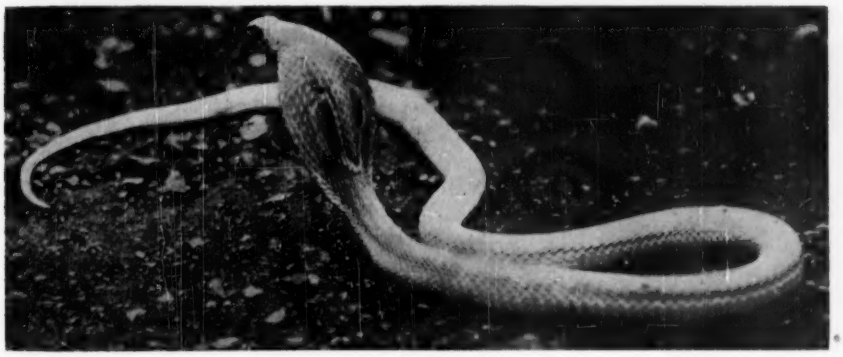
and peculiar skills.

From nose-tip to tail-tip the snake's body is covered with convex, overlapping scales, affording a tough covering so continuous that a portion of it—a clear "window" of transparent integument—covers even the snake's eyes. The backbone is engineered for tremendous suppleness. Its vertebrae are articulated by perfect ball-and-socket joints, a smooth polished ball on one vertebra fitting exactly into a half-round cup in the next. To each vertebra, throughout the length of the snake's body, is attached a pair of ribs. (Some snakes have more than 300 pairs.) There is no breastbone. Instead, each rib is joined by a cartilage and a set of powerful muscles to one of the scales on its underside. This is the secret of its gliding ability.

Snakes have four ways of moving. In the glide, a snake angles its ribs forward, hooks the ground with the attached scales on its underside, then gives a backward rib-push. The smooth, flowing glide of a snake is a beautifully synchronized, many-footed walking, all done from the inside.

Rattlers are not supposed, says legend, to crawl over a rope. But they will.

Needle-sharp, the teeth of snakes curve inward. In species that have venom one or two pairs of teeth are lengthened into fangs.



Most snake species are harmless to man—in fact, nine-tenths of all species—but the cobra is one of the venemous kinds.

For faster speed, snakes supplement this action of their "walking" ribs by undulating laterally in a wiggle that takes advantage of every projection in the terrain. At its maximum, this superb muscular exertion becomes the "sidewinding" used by snakes on desert sand. Where purchase is poor, a snake may thrust its head forward, hold it firmly to the ground, and then pull up the rest of its body.

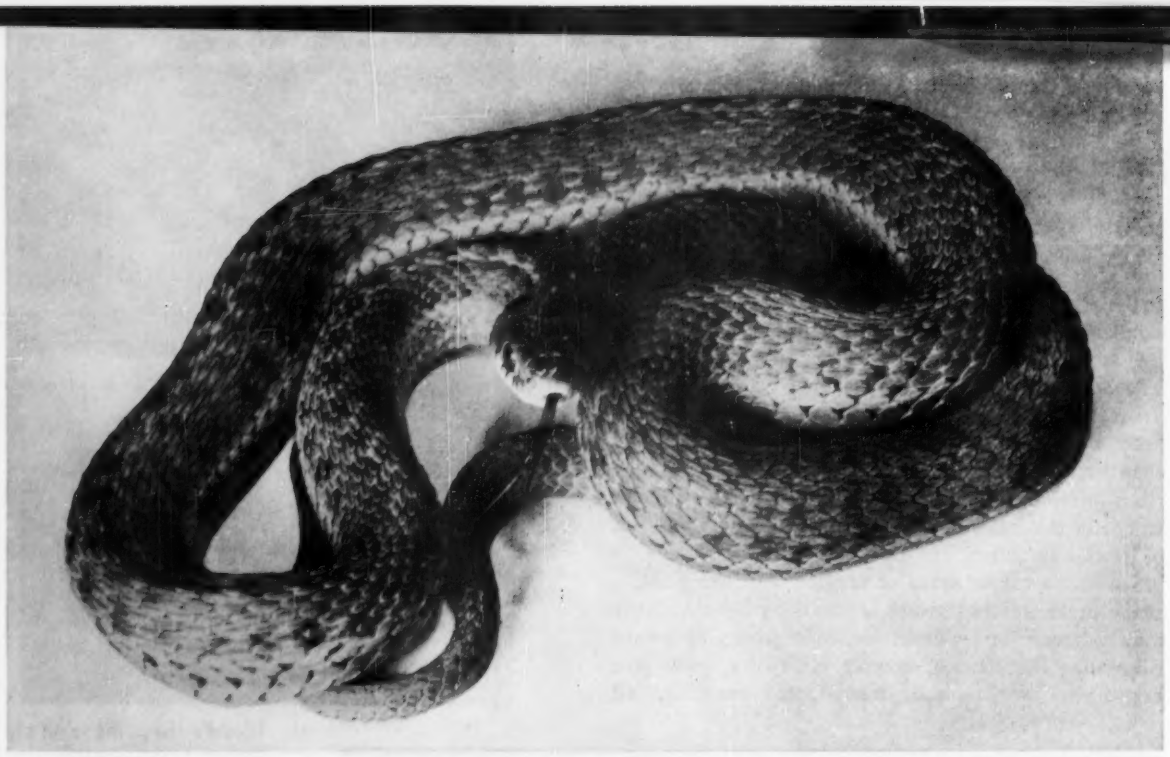
The speed of an attacking cobra has been compared to that of a cracking whip. Herpetologists say mambas are probably the fastest things on no legs.

Not only fast, snakes achieve prodigious acrobatics. Blacksnakes can race through the tops of shrubbery as fast as on the ground. I have watched a pine snake climb straight up a tree-trunk, just pressing its underside against roughnesses of the bark.

About three-fourths of all snakes begin their strange lives by hatching from eggs. (A minority are born alive from their mothers' bodies, sometimes in immense broods. A common water snake has been known to produce 76 babies in a litter, a garter snake 78.) Egg clutches vary in number from only a few to more than 70. The mother snake may deposit them in the sheltered lee of a boulder, hide them in an old stump, or bury them in sand.

A snake egg is not brittle, like a bird's, but slightly

Snake eggs are not brittle like those of a bird, and they increase in size after being laid. Here a red-bellied mud snake coils about its eggs.



A snake's tongue is an exquisitely delicate "hand" with which the creature touches and feels objects that it encounters, and it is also a means to super-smelling. This is a harmless garter snake. The milk snake at the left is one species about which there are many superstitions.

malleable. An extraordinary fact about it is that it increases in size after being laid. It may grow as much as one-third before hatching. How long that takes varies widely among different snakes. Some eggs hatch within four days, others take as long as 90. As a rule most snakes in temperate climates lay their eggs in June and July and the babies hatch in August or September. Research has recently disclosed that a mother snake may lay fertile eggs even though she has not met a male during the preceding spring breeding season. She can continue fertile for several years after mating.

The baby snake gets out of its egg by means of a temporary "egg tooth," as a chick does. From the moment of hatching it is ready to cope with its curious snake world. Among poisonous snakes, a newly-hatched baby is already venomous and knows instinctively how to use its equipment. A rattlesnake two minutes old can coil and strike expertly.

A snake lives in a world of silence, for it has no ears. Instead it "listens" with its sensitive underside for ground vibrations, and interprets scents. The snake also watches minutely; the eyes can focus in delicate adjustment to all near distances, like a precisely calibrated microscope. A night-foraging snake has eyes like a cat's, with vertical pupils. For smelling, there is the fabulous tongue.

A snake's tongue is both an exquisitely sensitive "hand"—used for delicately touching and feeling every strange object the snake encounters—and a means to super-smelling. As the snake flicks its tongue out, the fine forked tips pick up microscopic particles from the air, earth, water. Drawing in the tongue, the snake inserts the forked tips into two tiny pits in the roof of its mouth, called Jacobson's organ. Lined with keen sensory cells, these pits give the snake the precise scent and "feel" of the world the tongue has explored.

The snake's responses to what its tongue tells it are dramatically intense. A water snake will strike and bite its own body if a trace of fish-scent is daubed on it. When a rattlesnake's victim gets away, the snake trails it unerringly, following every twist and turn.

During its first year of life, a snake more than doubles its length, and may triple it during the second year. After that, the rate of growth slows but never entirely stops as long as the snake lives. This may account for the occasional giant snake exceeding the usual dimensions of its species—it may be an old-timer.

It is this rapid and steady growth that obliges a snake at regular intervals to change its tight and hampering skin, which does *not* grow. Except during the winter in northern climates, when snakes hibernate, the average

interval between skin changes is six weeks.

The new skin forms under the old. Presently the old skin begins to loosen and slacken as the folds between the scales flatten out. The snake rubs its nose and chin against a twig or rough-edged stone until it wears a hole in the old skin. It works its head free. Then, contracting its muscles rhythmically, pushing, pulling, thrusting against the ground, it slips the old skin off backward, inside out, like a peeled glove. Gleaming in fresh color, newly agile in a right-sized suit again, it resumes the rounds of its snake life.

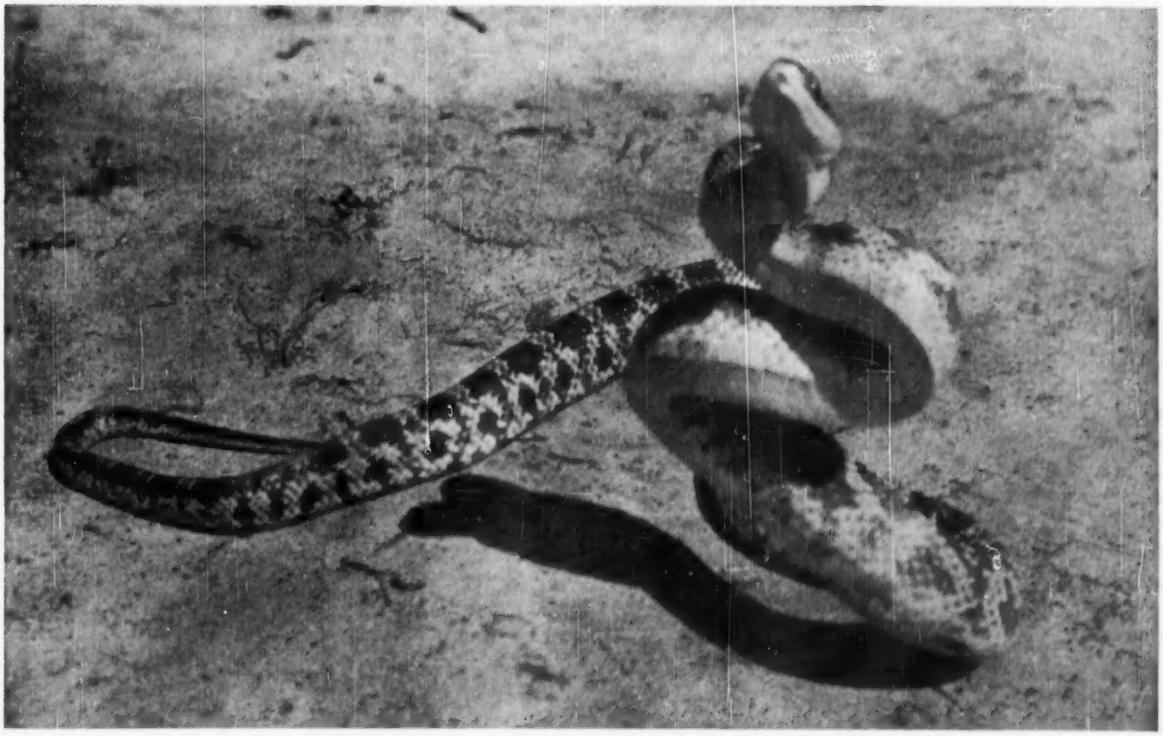
The snake's growth and energy expenditure need massive stoking, and since it may be able to catch prey only at undependable intervals Nature has insured that when the snake does have a chance to feed, it can swallow a bulk that will keep it going through a fast of over a year. Its mouth and jaws are amazingly constructed. Instead of having two rows of teeth, a snake has six; two in its lower jaw, two above, two more in the roof of its mouth. Needle sharp, the teeth all curve inward, making it almost impossible for a seized insect or small animal to pull away. Vitally important in the snake's life, its teeth grow in a continual succession of replacements. New ones form and push through as long as it lives.

A special mouth construction permits cavernous openings. All the movable bones of the snake's head are loosely articulated. The bones of its lower jaw can be separated from the upper. Each side of the jaw can be worked independently, the two halves being connected only by elastic ligament. Even the arches of the snake's palate are movable.

The result of this uniquely pliable, powerful construction, combined with the inward-hooked teeth, is that a snake can perform eating feats that seem mechanically impossible. A slender garter snake has been known to eat 30 tree frogs in succession. Many snakes can engulf large birds' eggs without breaking them. A bullsnake at Bronx Zoo swallowed whole 14 hen's eggs in a row. To digest its big unchewed meals, a snake is equipped with gastric juices potent enough to break down fur, feathers, even teeth.

In the snake species that have venom, one or two pairs of teeth are lengthened into fangs. Grooved or hollow, these connect with sacs of poison in the snake's cheeks. At the moment of biting, the snake gives a powerful squeeze of its poison sacs and squirts a jet of venom into its victim. The coordinated speed of a poisonous snake's lunging strike, bite, poison injection and return to normal stance, is one of the most startling feats of agility in Nature. The whole (*continued on page 498*)

The rattler at the right is one snake to be avoided, but if bitten by one the author gives advice on what to do. Below, however, is the harmless chicken snake that has assumed a pose calculated to strike fear into the heart of any one who does not know what snakes are really like.



Along the Wakulla River, just below Wakulla Spring, a rare limpkin poses in the shadow of a huge cypress.

There are many surprises along the trail of

Mystery in Apalachee

By BLANCHE McKNIGHT

IN NORTHWEST Florida, where the panhandle meets the peninsula, lies the Apalachee country, one of the most interesting and mysterious regions anywhere. This is a land of underground rivers, "natural bridges," and incredibly copious springs; caverns and sinks that expose centuries of Florida's development; lakes that vanish practically over night and reappear almost as suddenly, then years later repeat the act.

For untold years before the coming of the white man, the Apalachee, which stretches east and west between the Aucilla and Ochlockonee rivers, and from the Gulf of Mexico to the Georgia line on the north, was the acknowledged domain of the Apalachee Indians, powerful tribe of the great Muscogee Federation. Although the Apalachee were decimated by the English in 1703-4, the fame of these redmen, who forced de Narvaez out of Florida and gave no little trouble to his successor, DeSoto, lingers in the names of rivers, towns and bays and in the great Appalachian Mountain system.

Much of Apalachee is unchanged down through the years, and the traveler today sees the same geological "freaks" as delighted the ancient Indians and Spaniards. These natural curiosities, such as the Wakulla Spring, one of the geological wonders of the region, gave rise to many legends amongst the early Indians. The fame of Wakulla spread throughout Apalachee as "The Fountain of Youth," due to the supposedly healing properties of its waters. One legend says that this is the spring into which Ponce de Leon, earliest Spanish explorer dipped, and came out cleaner, but, alas! no younger.

To see this land of enchantment, where physical phenomena are everywhere, a good starting point is Tallahassee, capital of Florida. For Tallahassee is not only the approximate center and capital of the old Apalachee country, but it is the focal point from which major highways of all of northwest Florida radiate.

Geologically this section is a "freak;" for sinks or "potholes," which vary in size from a few feet in diameter to several miles across, and in depth from a few inches to a seemingly bottomless pit, mark the entire area. These occur when the soft limestone lying below the surface is eaten away by circulating ground water and chemical action and the surface caves in.

Dr. Raymond F. Bellamy of Florida State University's Department of Zoology, who knows every nook and cranny in this section, compares it to a huge sponge. He says "that one could spend a lifetime exploring and studying the sink holes within a radius of twenty-five miles of Tallahassee without exhausting the possibilities."

One of the most interesting and deepest limestone sinks in the area is Dismal Sink, about eight miles south of the capital city. Nearly circular, with steep sides and a depth of approximately 100 feet, it has trails leading down the sides at several points. At many places the formation is exposed, revealing millions of tiny shells and crustaceans, which indicate that even this far north the Florida peninsula rose from the sea centuries ago.

The water level in Dismal Sink varies with the rainfall and possible subsurface drainage in and out.

Dr. Herman Gunter, state geologist, believes there is some underground connection among many of the sinks in this section. It is quite probable, he says, that water from Lake Bradford, north of Tallahassee, may find its way into Wakulla Spring, some sixteen miles distant.

Six-Mile Pond, south of the city, just off the Gulf Coast Highway, is in reality another huge, water-filled sink. Rhodes Springs, left of the village of Woodville, are a series of spring-fed sinks, the largest eighty-five feet deep.

One of the most interesting farther down the State, in the vicinity of Gainesville, is the Devil's Mill Hopper. Resembling a huge funnel, this immense sink, 115 feet in depth, and 500 feet across at the top, gradually tapers down to a width of about sixty feet at the bottom. No less than fourteen springs cascade down its sides, filling a pool and draining through an underground outlet. Sometimes the exit becomes blocked and the water rises fifteen or twenty feet. Huge hardwood trees rise from the banks of the sink, revealing its great age, while violets, ferns, dogwoods and magnolias grow along its sides in profusion.

In this same vicinity is another famous solution basin —Payne's Prairie or Alachua Lake, covering several miles in area, which sometimes is and sometimes is not a lake.

In the field of disappearing streams, Gopher Hole Sink, deep in the woodlands south of Tallahassee, is an arresting example. The side of a hill has apparently been washed away, leaving exposed a subterranean stream in a small cave. This stream is visible for a short distance, then vanishes from view. The picturesque name apparently was given it by some adventurer because of its resemblance to a gopher hole, so prevalent in this area.

To the southeast is River Sink, said to be the shortest river in the world. No dainty trickle of water is this river, but a full-throated, crystal-clear flood that pours from a sink-like depression, fifty feet in diameter, and flows rapidly for about 100 yards, then suddenly disappears into the earth and is lost to further knowledge.

Natural Bridge, about fifteen miles south of Florida's capital, is typical of a landscape marked by rivers that take sudden dives below the surface, leaving arches of limestone and chasms to mark their eccentric path. Here was fought the Civil War battle that left Tallahassee the only Confederate capital east of the Mississippi not seized by Federal forces.

Other notable examples of natural bridges and caverns are seen in the Chipola River, near Marianna, some distance west of Tallahassee. Over one of these natural bridges, formed by the Chipola disappearing into a cavern to rise a short distance away, legend says that Andrew Jackson marched his troops in pursuit of the Seminoles, while the Indians were hidden beneath, wholly unknown to the General and his command.

Greatest of all the caves in the Chipola River valley, or even in the State, are the "Florida Caverns," developed by the State Park Service as Florida Caverns State Park and opened and lighted for public visitation.

Here, in this land of subterranean splendor, the visitor can see an amazing network of passageways, an underground river, limestone escarpments, and fantastic icicle-like formations.

Lake Iamonia—called Lake Hiamonee by the Seminole Indians—twenty miles north of Tallahassee, has become a striking example among Florida's disappearing lakes. This lake disappears and reappears with almost uncanny regularity. However, according to early records, its waters existed as a conventional body, staying "put," as it were, and behaving like any normal lake should, until 1910, when it sprang a "leak."

Earliest mention of Lake Iamonia can be found on the Purcell-Stewart map of 1778 where it appears as La-Harmonie. Later mention occurs in 1823, the year before Tallahassee was founded. Imagine, if you can, one old settler's surprise and consternation, one bright May

Lake Iamonia, a ten-mile-long body of water 18 miles north of Tallahassee, on December 18, 1933. The "lake" photographed from the same spot (below) in November, 1934, after the lake had disappeared save for a small trickle of water.

COURTESY FLORIDA PARK SERVICE

The "Cathedral Room" in Florida Caverns with its majestic cascade of stalactites. Below, Devil's Mill Hopper, a famous sinkhole several miles southwest of Gainesville, Florida. An underground stream weakened the limestone substructure and caused the cave-in.

it has come and gone three times. Its latest "uncorking" occured in 1946.

A dam built by the Leon County Commission and the State Game and Fresh Water Fish Commission today holds back the main body of the lake and serves a useful conservation purpose, but it is anybody's guess as to when and where a new "leak" may develop. Exactly why the lake goes AWOL has never been fully explained. Dr. Gunter believes the ground level of water, which drops during prolonged drought, may contribute to the downward flow. He also offers the opinion that the "breaking through" of the topsoil results from rainwater absorbing organic and mineral acids in its trip underground. "Working under the limestone," Dr. Gunter points out, "this charged water causes the crust to break through, forming a typical sink hole through which the water flows."

Scientists scoff at the legendary tales of the loud

morning in 1910, when he appeared at the lake for a day of fishing, only to find an empty marsh! Thirty square miles of prairie seethed beneath the broiling sun where the lake had been.

The sensational news spread like a dry forest fire, and many weird and strange tales made the round of the "Hiamonee" community. One version was that several families living nearby had been awakened during the night by a loud, roaring noise, which later became a deep gurgling sound. And the next morning, so the story goes, there were others who saw what the old settler had seen—just a muddy morass and weeds, stranded boats and literally thousands of dead fish.

Shortly after the Old-Timer's visit the lake started to refill, and soon was back to normal. Everybody was happy, hunter, fisherman and picnicker alike, until, in 1917, Lake Iamonia staged another fadeout. Since 1910 roaring of the water as it escapes, maintaining that tht waters do not disappear instantaneously, but do, in face require a period of several days and sometimes weeks to flow out entirely. They further state that these periodic lakes, in most instances, refill slowly, depending upon rainfall. Some, however, have remained practically dry for several years.

Lake Jackson, embracing several thousand acres, about six miles northwest of the city, also staged the disappearing act around the turn of the century. According to legend a similar exhibition took place in 1837.

Because of its rolling topography, its limestone foundation, and the action of underground waters, new sinks are constantly forming in the Apalachee country. Unconfirmed stories exist of holes opening in the ground and swallowing farmer, mule and land. There is the

confirmed story that, during World War II, a sink suddenly appeared close by an ammunition dump at Dale Mabry Field, near Tallahassee. The explosives were removed in time to prevent a catastrophe.

William Bartram, naturalist and explorer, who visited this section during the Revolutionary War period, describes the formation of a sink in his book, *Bartram's Travels, 1791*. Bartram reports that he saw the water gushing from the ground in a geyser with a roaring noise, later ceasing and "leaving this capacious basin of water, which, though continually near full, hath never since overflowed." He was describing Alligator Hole in the northwestern part of Levy County. But geologists believe that his description about the water shooting from the ground in a geyser was somewhat exaggerated.

Having the same origin as the sinks, are the natural wells of this section.

These are usually only a few feet in diameter and

COURTESY FLORIDA PARK SERVICE

Young visitors to Florida Caverns gaze into the "Wishing Well." Note the rough stalagmites. Below, Wakulla Spring, which rises from a cavern deep in the limestone rocks. Its waters spread over a four-acre basin before moving toward the Gulf as the Wakulla River.

resemble great tubes or pipes driven more than 100 feet into the earth. Kirk Monroe, in his fascinating book, *Wakulla*, lets Mark Elmer, hero of his story, who was out hunting with a companion, fall from a horse into one of these natural wells, and be carried for miles into the current of the underground stream with which the "well" was connected. Hours later he was rescued at a point where the subterranean flow reached another "natural well." This was the source of water supply for a Wakulla County family, and when the daughter of the household went to draw a bucketful of water she saw something which made her run to the house screaming, "Pa, come here quick! The Devil's in our well, and he hollered at me!" Mark Elmer's companion happened to be at this home hunting for his lost friend, and the girl's discovery led to the rescue.

From the great network of underground rivers in the Apalachee comes the astonishing Wakulla Spring, eighteen miles south of Tallahassee. Reached from the Gulf Coast Highway by a winding drive through a virgin forest of oak, hickory, cypress and magnolia, Wakulla has a wild beauty and charm that has not been spoiled by artificial attempts to beautify its surroundings. Wild plum, crabapple, dogwood and the redbud or Judas tree fill the scene with color in the springtime, while yellow jasmine scents the air with spicy fragrance.

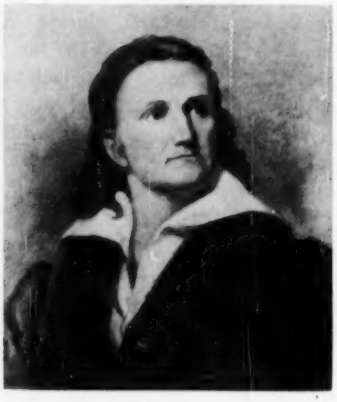
The Spring itself rises from a cavern deep in the limestone rocks, and its waters spread out over a four-acre basin before racing off toward the Gulf of Mexico as the Wakulla River. Sidney Lanier called this Spring, "one of the most remarkable in America, which sends off a full-grown river at a single outburst."

While thousands swim, boat and aquaplane on this great open-air aquarium, the *(continued on page 498)*

Audubon's first home in America was

MILL GROVE

By J. D'ARCY NORTHWOOD



John James Audubon as painted by Henry Inman in 1833.

Mill Grove, the Audubon shrine, as it is today. At the right is the lower-level addition built by the original owner to take care of stranded travelers. The main house was built in 1762, and the west wing was added three years later.

MILL GROVE is the old name of the house where John James Audubon first lived when he came to America. It lies in the historic Valley Forge country. Washington's Headquarters are only three miles away across the Schuylkill River, and Philadelphia is twenty miles to the east. It was built by a miller, James Morgan, who had a mill on the Perkiomen Creek, which flows at the bottom of the hill on which the house is built. He must have done well in business to be able to build himself such an imposing place; perhaps marrying a rich girl had something to do with it as well.

The main house was built in 1762, three years later a west wing was added, on a lower level. This gives the addition the appearance of a chick nestling under its mother's wing, and prompts one to ask the reason of the odd arrangement. The explanation given is that, in the old days, the road to the ford near the house was steep and in wet weather coaches were stuck in the mud. The passengers would walk across the meadow to the fine house on top of the hill and ask for shelter until their coach could get on the road again.

The miller soon had enough of this and built the wing to take care of the stranded travelers. The large room on ground floor was licensed as a tavern, the rooms upstairs rented as bedrooms, the net result being that the miller had a good income from the bar and from the rooms, and, also, had his own house to himself again.

One of the old millstones now provides the last step of the flight leading to the lower level. Local legend has it that there is a secret chamber in the old chimney of the wing. It is certainly massive enough to contain one.

The only inhabitants of the chimneys now are chimney swifts. A colony of thirty to forty pairs nest inside, providing quite a show on summer evenings at dusk. They sweep by in circles and, when above the chimney, check speed suddenly and parachute in with uplifted wings. Nests sometimes fall down the chimneys and are found in the fireplaces. They are little hammocks of twigs broken from the trees by the birds in flight and glued to the walls of the chimney with saliva.

The ivy on the walls is old. Visitors are often surprised to see the flowers, balls of yellow stamens that are replaced by blue fruits late in the fall. While the ivy is in flower thousands of hornets, yellow jackets and bees come for the nectar, their last good feed of the year.

Phoebes have nested on a ledge under the back porch for the past sixty years. Perhaps they are the direct descendants of the phoebes that Audubon banded in his cave.

Later owners of the mansion include John Penn, a grandson of William Penn and the last English governor of Pennsylvania.

In 1789 the house was bought by Capt. Jean Audubon, the father of John James Audubon. The captain was in Philadelphia on business. He was looking for an investment for his money, with which he had escaped from Santo Domingo, a French colony in the West Indies. There had been a slave insurrection and Capt. Audubon had to get out in a hurry. Mill Grove was for sale and he bought it, purely as an investment, for there was a small lead mine on the place and no doubt he hoped to find other minerals. He never lived at Mill Grove, and, shortly after buying it, he returned to France to his estate near Nantes, receiving the rents from his property in America each year.

In 1803 Capt. Audubon was worried about his son's future and decided to send him back to America to take charge of the estate and perhaps make the family fortune by developing the minerals at Mill Grove. Young Audubon landed in New York and promptly caught yellow fever, but was nursed back to health by two Quaker ladies.

At last he arrived at Mill Grove, early in the spring of 1804, when he was nineteen years old. He was enchanted with the place, and with the birds. As a boy in France he had painted pictures of the European birds; here was a whole new world of them. The mines were ignored; each day John James sallied forth with his gun to collect more beautiful birds for his brush. But his pictures did not represent the lovely creatures he saw in the forests, full of life and action. How could he get those attitudes on canvas?

Bird artists before Audubon had all followed the same style of showing a bird as a wooden profile on a twig. He was the first to show a bird in its natural habitat and full of life and movement. This technique he started at Mill Grove, first collecting the bird and then working pliable wires through the body and bending them into the attitudes he wanted. Then he finished the picture in one sitting.

Another important event happened during the year he lived at Mill Grove. He met Lucy Bakewell, the daughter of William Bakewell, who owned the neighboring estate of Fatland. The young people fell in love and a few years later were married.

Audubon was not a model husband. He left the support of his family to his wife, who taught school while her husband was off on his expeditions, being gone for weeks and months at a time. But she understood him and was proud of him. When he needed money at a critical time to get his pictures published she gave him her savings and sent him to England, where he at last obtained recognition and fame.

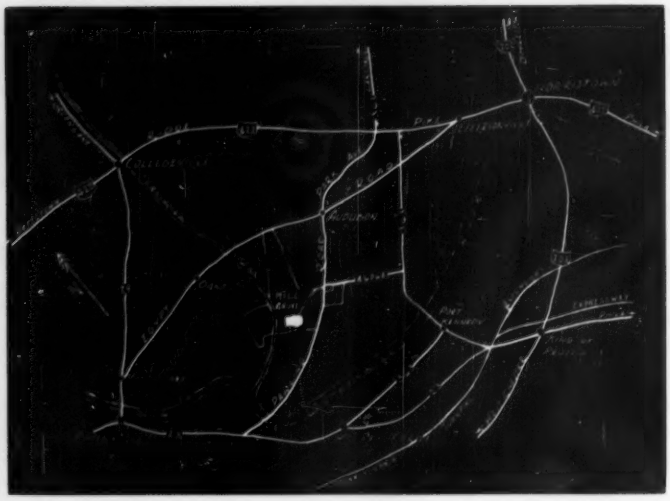
During his explorations at Mill Grove, the young man had found a cave on the steep bank of the creek. This was so attractive that he made it his headquarters. Soon he found that other occupants had a home there, a pair of pewees (or phoebes as they are now called) had a nest on a ledge. He had many opportunities to study the confiding little family of birds and the thought came to him that if he could mark the young ones in some way he might learn if they returned to the locality the next year. This he did by placing silver wires on the legs of the young phoebes and, sure enough, next year he saw one or two phoebes with his wires on their legs. Does this entitle him to the added distinction of being the first bird-bander of America?

PHOTOGRAPH BY RAYMOND J. MIDDLETON, JR.

View from the porch of Mill Grove looking at the small pond at the foot of the hill.

Visitors in later years often ask to see the cave where Audubon banded the phoebes. It is not generally known that it no longer exists. In the *Ornithological Biography* he tells us that on a visit some years later he went to the cave and found it destroyed, the stone had been used for a new dam.

After the place was sold by Audubon it changed hands a few times and in 1813 was bought by Samuel Wetherill. It remained in the Wetherill family almost continuously for 140 years. They lived in Philadelphia, Mill Grove was their country home and they took care of it. In 1951 it was bought by the Commissioners of Montgomery County. It is maintained as an Audubon Shrine —a memorial to John James Audubon. On the walls are hung twenty-four of the famous elephant folio prints,



Mill Grove lies in the historic Valley Forge country. Washington's Headquarters are three miles away across the Schuykill River, and Philadelphia is twenty miles to the east.

the first edition that was done in London between 1828-38. These are life-size reproductions of the original watercolors, about 40 x 30 inches. There were 435 in the complete set and about 200 complete sets were made, about 87,000 handcolored prints, an enormous volume of work. It is not known how many complete sets are in existence today, perhaps thirty or forty. The last set that was sold went for between $40,000 and $50,000.

During the ten years of publication Audubon made several large oil paintings, which were sold to raise funds for the work. One of these pictures, "The Eagle and the Lamb," hangs at Mill Grove. It is a dramatic picture of a golden eagle pouncing on a lamb. It is full of action; typically Audubon.

The estate of 120 acres is a wildlife sanctuary. Feeding stations are maintained, nesting boxes are available and a tree nursery of about 4000 trees and shrubs that bear fruits attractive to wildlife has been started. These are planted out in suitable locations in the woods and meadows.

Since picnicking, fishing and swimming are not allowed in the Sanctuary an additional area of 30 acres across the creek is developed as a park. Here are picnic tables and stone fireplaces. Firewood is provided. This, like the shrine, is open the year round.

There are between four and five miles of trails, laid out so that visitors may have easy access to beauty spots. Many groups of all ages come to the shrine to make use of the cultural and educational opportunities that are available. The Norristown Garden Club has taken over one of the trails as a wildflower conservation project. There are exceptionally fine stands of wildflowers through the woods.

Extensive alterations are now in progress to make the place even more attractive. The old floors are being strengthened and relaid with random widths of native red pine taken from another old house. Murals that will show scenes of Audubon's travels and adventures in the primeval forest will be displayed. In the center of each room show cases will contain old maps, one of the original copper-plate engravings and other objects relating to Audubon.

Always Mill Grove will be "that blessed spot," Audubon's own words for it. Here he first studied the American birds and laid the foundations for *The Birds of America*, those wonderful pictures of birds that made him world famous.

Mill Grove is still a good place to see birds. In less than two years 135 different species have been listed. The woods, meadows, streams and the creek attract a varied assortment. Many that would not normally be expected are found here, last year a pair of prothonotary warblers raised a family. The birds, too, are finding Mill Grove "that blessed spot."

THE GATHERER

She walks the autumn woods expectantly,
With wonder in her heart and in her eyes;
Beneath each crumbling log and moulding leaf,
Concealed for her to find, a sweet surprise.

With careful hands she digs a bit of moss,
Or from a rock a partridgeberry twined,
But when she takes her basket home at dusk,
Something of herself is left behind.

I think that she is gentle all her days.
Respecting life, her pleasure is to share.
She is not greedy with her gathered store,
But leaves a little beauty everywhere.

Virginia Burr Lincoln

For California's Indians

Nature ran an

OUTDOOR STORE

By KEN LEGG

Photographs, unless otherwise indicated, by the author.

The yuccas served many purposes in the life of California's Indians.

IN THESE times of fancy packaging of foods, which makes them seem far removed from the soil in which they grew, it is interesting to look back a hundred years, or more, to the California Indian and his dependence upon the plant kingdom.

Not only did these early inhabitants have no grocery, of course, to supply their food, but there were no drug stores for medicine or department stores for clothing and household needs. The great outdoors, undisturbed and abundant in its resources, was the storeroom of these non-agricultural dwellers of California prior to the Mission period.

Historians, wondering at the lack of agricultural interest shown by the California Indians, have advanced reasons as to why they did not grow crops. Some feel that the abundance of natural food was a factor, for who needs to grow fruit and bulbs, seeds and stems when the woods are full of them?

Many species of wild plants, as well as different plant parts, were used for food. The acorn fruit of the various oaks is well known as a staple in the Indian's diet. The white population has always shunned the fruit of these trees as food, but has realized the value of acorns for fattening hogs. It is significant that the fattest of all Indians were those of California, a tribute to the acorn's nourishing qualities.

Because of the tannic acid in them, many acorns are bitter, but by first grinding, then soaking and draining them, the aborigines leached out the bitterness. In autumn, when the fruit of the oak became ripe, they were gathered in baskets and laid in the sun. Those to be consumed at once were shelled and reduced to fine powder by grinding in stone mortars. Beside the nearest water, every acorn-eating family had a leaching plant composed of a nest of twigs and leaves. Over this was stretched a piece of porous material, sagging in the middle. Here the acorn meal was placed and water poured over it for two or three hours, the bitterness dripping away with the water.

Catkins of the quinine bush. This shrub was used to provide medicine to allay fever.

Perhaps we can imagine the squaws, as they worked at the leaching, exchanging favorite recipes. When the

Flower of the gum plant. The plants, when boiled, yielded a remedy for poison oak.

Bulb of the soap plant. This yielded soap and squaws would also use it to work up a lather in pools containing fishes, thus stupefying the fishes so they could be caught by hand.

Flowers and leaves of the California buckeye. The seeds of this plant were used by the California Indians during hard times. The pods are gathered today for decoration.

doughy mass was thoroughly sweetened, clear water was added and the mixture was boiled into mush. Another way of preparing the acorns was by making a kind of bread dough. A little red clay was mixed with the dough to help remove any remaining traces of tannic acid. These loaves were covered with heated stones and earth, and it was not pancakes the squaws served for breakfast, but, after being buried all night, black bread.

Various tubers, roots and bulbs were found to be edible and were utilized by the primitive inhabitants. Among the bulbs most commonly used for food were those of the plants of the numerous lily family. Bulbs of the genus *Calochortus*, such as the sego lily and the mariposa tulip, were eaten with great relish, and white settlers who tried them roasted attested their nut-like sweetness. The bulb of the common blue brodiaea, *Brodiaea capitata*, was also harvested and consumed by the Indians, as was *Camassia* or "Indian potato." Care was exercised in the gathering of this bulb, for another plant, *Zygadene venenosus*, resembles the camass but is poisonous. This plant was known to the Indian as death camas. Certain Indian medicine men, being aware of the effects of zygadene, are said to have purposely given it to their brethern to make them sick so that the medicine men might make them well.

Most of the seeds employed as food were gathered dry and ground into flour. Seeds of the chia, *Salvia columbariae*, one of the sages, was made into a mush. Also the seeds of white sage, the mature fruit of the yucca, seeds of various wild grasses and *Rumex*, a genus of weed-like herbs, were collected for food. Smaller, copious seeds were harvested by holding a basket under the bent plant head and shaking it.

In the southern half of California the olive-sized fruit of one of the wild plums, *Prunus ilicifolia*, is rather disappointing as a fruit, because it is practically all pit. But the ingenious Indian cracked these large pits and extracted the meat for food. The large seed of the California buckeye gives a good example of the resource of the Indian. In fall and winter, its beautiful flower-spikes and leaves gone, the buckeye stands in deciduous nakedness upon the hillsides. Only oval, leathery pods hang from limbs, which produced such luxuriant summer foliage. The seed is now considered poisonous, but, as with other wild plants regarded as undesirable by whites, the Indian was able to leach the poison from the nut, and it was eaten in hard times. These pods are gathered today and painted in different bright colors and hung, along with gourds, dried cones and seed pods, as a decoration in patios or doorways.

Not all was seed and bulb in the Indian's diet, however, for we find many cases in which stem and leaf parts were eaten. In the spring the Indian squaws searched eagerly for the first of these various green spears as a welcome change from their winter diet of acorns and bulbs. Tender shoots of the prince's plume, *Stanleya pinnata*, a plant of the dry plains and foothills, were boiled and eaten like asparagus. New stalks of the usually solitary-stalked fern known as bracken, *Pteris*, also resembled asparagus. Another spring dish was provided by the tender shoots of the yucca, or Spanish bayonet, while, later in the season, its seeds were gathered and ground into flour.

As a salad one of the best known and most widely used was Indian or miner's lettuce, moderately succulent herbs of the genus *Montia*. The Forty-niners are said to have eaten it. One Indian tribe even had a tangy dressing for this lettuce. Large quantities of leaves and stems were picked and laid in ant hills, the ants crawling over the plants giving them a flavor not unlike vinegar.

Fruit in season was likewise an important part of the Indian's fare, all of the common species of berries being eaten. Certain wild fruits, now little regarded, were used in addition to the strawberry, elderberry and the wild grape. Fruits of the manzanita and its larger relative, the madrone, were eaten in quantity.

Berries of the California redberry, *Rhamnus crocea*, were also consumed, and one early surgeon relates a gruesome story of seeing some twenty dead Apaches whose bodies were beautifully reticulated in red from the juice of *Rhamnus* berries, upon which the Indians had gorged themselves before being killed by the troops. The color was taken up by the blood and diffused through the smaller veins, thus forming this intricate pattern of red lines crossing and recrossing.

Neither was the early California Indian without his beverage. The lemonade-berry, *Rhus integrifolia*, was used to make a thirst quencher, the seeds producing a lemon-like juice. Indeed, they even made an intoxicating beverage from the fruit of the wild plum. The herbage of many plants was boiled and used as tea. A great number of these were thought to possess curative powers, which in many cases they did. Tea of the blue-eyed grass, *Sisyrinchium bellum*, is said to sustain a sick person for several days, while the little, vine-like yerba Buena, *Micromeria charnissonis*, was used to allay fever and to relieve indigestion.

To correct the effects of an acorn diet the Indians found near at hand and abundant the bitter bark of the shrub *Rhamnus purshiana*, or cascara bush. Many of the plants used by the Indian for medicinal purposes are of doubtful worth, but the cascara is one to be respected because of its ability to relieve chronic constipation. The value of this plant was so great that the Spanish bestowed upon it the name cascara sagrada—the sacred bark—and it is now regarded as one of the safest and best laxatives in the world, going into a preparation made for babies.

Other common plants used for medicinal purposes include the gum plant, *Grindelia robusta*. This was employed not only as a cure for poison oak, but for whooping cough, asthma and other lung and throat troubles. Grindelia today is sold as a drug. Yerba Santa, *Eriodictyon californicum*, (the saintly herb) was used as a remedy for colds, and the yerba del Pasmo, *Adenostoma sparsifolium*, was treatment for snake bite, lockjaw and cramps. The quinine bush, *Garrya*, was used to relieve fever, and the common pennyroyal was prized as a blood purifier.

Besides food and medicine, other plant uses came into the Indian's life. Pliable young shoots of the squaw bush, *Rhus trilobata*, were used in basket-making, and the yuccas, a plant of many uses, yielded important fibers employed in the manufacture of sandals, rope and cloth. Soap was made from *Chlorogalum pomeridianum*, the bulb of which is highly saponaceous. Indians of the Sierra foothills had another use for this same plant. When small pools containing fish were left after the spring freshets, the squaws went to these pools and, kneeling upon the bank, rubbed up a great lather in the water by using soap plant bulbs. This solution stupified the fish, which rose to the surface and were easily caught.

A tea was brewed by the Indians from the blue-eyed grass, and it was said to have sufficient nourishment to sustain a sick person for a week. Nature supplied various medicines.

PHOTOGRAPH BY FRANCIS WILLIAMSON

Indian, or miner's lettuce supplied a salad, the stems and leaves being eaten raw. It is said to have been eaten by the Forty-niners, hence one of its popular names.

These and many other incidents show clearly that the earlier California inhabitants found valuable uses for a wide variety of common plants. In the eyes of many, city youngsters in particular, plants no longer come from the soil, but from the mist-drenched counters of supermarkets. Arranged so artistically upon their tables, these cellophane-packaged foods seem to have "grown" in the back room sans sun, rain and soil. Such a deluxe process of food procurement is far removed from that of the Indian, who surely realized that the land was the giver of all food.

Cottonwood:

Boon to the Pioneer

By RUTH H. DUDLEY

U.S. Forest Service Photograph

Kansas has recognized the debt of the early settlers to the cottonwood tree by officially selecting it as the State Tree.

"The cottonwood tree can rightfully be called 'the pioneer tree of Kansas'." So states the Kansas law drawn up to make the cottonwood the official State tree. "If the full truth were known it might honestly be said that the successful growth of the Cottonwood grove on the homestead was often the determining factor in the decision of the homesteader to 'stick it out until he could prove his claim'."

No special species is mentioned as the Kansas State tree but the eastern cottonwood, *Populus deltoides*, is the one generally regarded as the choice. However, its smaller relative, the plains cottonwood, also played an important part in the life of the early settlers.

The fact that the cottonwood is the fastest-growing tree in North America meant much to the pioneers. Also they were awed by the ease with which new trees spring up, both from the abundant cottony seeds and the self-pruned twigs.

These trees are hardy, too, although short-lived. A seventy-five-year-old tree is old, with its heartwood probably eaten away. Cottonwoods stood bravely against the howling blizzards of winter, and offered sweet shelter and shade against the summer's heat and drought. To many a weary pioneer a cottonwood oasis on the parched prairie was indeed a blessing.

The wood of the cottonwood is not valued highly commercially, checking and warping while seasoning. Nevertheless, it served the pioneers well, and from it they built their corn cribs and fences, their cabins, schools and churches, and its wood served a multitude of other purposes.

Besides Kansas, the eastern cottonwood grows in much of the eastern half of the United States, except Florida, the coastal area from Texas to Cape Hatteras and eastern New England. It is a good-sized tree, sometimes growing to 150 feet.

The plains cottonwood, *Populus sargentii*, was vital, too, in the settlement of the West. It grew abundantly along streams and water holes, and made wonderful oases for the pioneers travelling the Oregon and the Santa Fe trails. It offered the only shelter, in fact, for hundreds of miles.

The State Tree of Wyoming, too, is often called a cottonwood. It is the lovely balsam poplar, *Populus balsamifera*. The balsam fragrance of the clear gum thickly covering the buds gives it its name. It is a hardy tree, growing sixty to one hundred feet tall, and is found all across the northern part of our country, and in Canada.

The cottonwood belongs to the genus *Populus*, which includes the aspens and poplars. There are some thirty known varieties of these trees in the world.

THE ADVANCE

Our walls head off the trees
Whenever they start to run.
But seedlings wait at ease
With rain and wind and sun,
Until our minds relax,
And we forget them all.
We hardly turn our backs
Before they climb the wall.

Daniel Smythe

The zacatuche, or volcano rabbit, lives in a restricted zone above nine thousand feet elevation in the mountains of Mexico.

Zacatuche

By ELIZABETH INGLES

Photographs by Lloyd G. Ingles

On the continental backbone of Mexico, nearly forty miles southeast of Mexico City, the volcano, Popocatépetl, thrusts its snow-capped head to an elevation of some 17,800 feet into the deep blue sky. Often clouds shroud the mountain and icy winds from perpetual snows chill the region close to timber line. This region is called the zacatón, and designates the plant community that has its roots in the great transverse volcanic region of the interior plateau of southern Mexico. It occupies a belt about four hundred miles long and some sixty miles wide. Here among tall bunch grasses, fescues, and the dense thickets of an aromatic herb, is the home of the zacatuche, or volcano rabbit.

The well-known Mexican mammalogist, Señor Bernardo Villa R. introduced us to the zacatuche. As our car climbed from the little town of Amecameca in the State of Mexico up the well-graded dirt road toward the pass of Cortés, I noticed that at about 9000 feet thick bunch grasses began to grow in open places in the pine-fir forest. But it was not until the road ended near the hikers' shelter house at about 13,000 feet that I saw my first zacatuche. As the little rabbit, with a piercing cry, scampered for the cover of thick bunch grasses I was reminded of another lagomorph of the high country, the pika. In appearance the two are similar, although the volcano rabbit is the larger and wears a heavier clay-colored coat. Both have relatively small ears and neither can boast much of a tail. But it is in the voice that the greatest similarity lies. This is clear, penetrating, and ventriloquistic. Many times I have climbed over the talus slope of a western mountain, following the "eenk-eenk" cry of a pika, only finally to spot the little fellow hunched on a rock in another direction. Señor Villa reports similar experiences with the zacatuche, which he says will also run and peep out from volcanic rocks like our pika, although it prefers to live in its tunnels in the thick zacatón.

Romerolagus diazi, the name by which mammalogists speak of the volcano rabbit, lives in a restricted zone in the high mountains at an altitude of 9000 to 13,500 feet. It is strictly a Mexican species; it is found nowhere else in the world. But here in the right habitat it is relatively common. On another trip afield in the mountains close to Cuernavaca, in the State of Morelos, we found many runways worn through the heavy stands of zacatón and were at last able to capture one of the animals in a live trap for a photograph. Here the grasses were too high and too thick to allow more than a fleeting glimpse of the animal before it disappeared into the cover. Here we discovered these "grass-root jungles" were also the

The majestic cone of Mt. Popocatépetl stands guard over the Valley of Mexico. Here summer rains and winter "northers" sometimes blanket the home of the volcano rabbit in a heavy drizzily fog for two or three days.

The grasses of the zacaton grow higher than this eight year old boy is tall. Here the zacatuche makes its home.

homes of three other distinctive species of mammals, the volcano mouse, the beautiful golden-backed harvest mouse, and the giant Merriam pocket gopher.

Señor Villa and one of his students have made extensive studies of the zacatuche. Once, under the root of a fallen pine, they discovered a nest. Here, in a hole lined with dry pine needles and the soft belly fur of the mother, were three young.

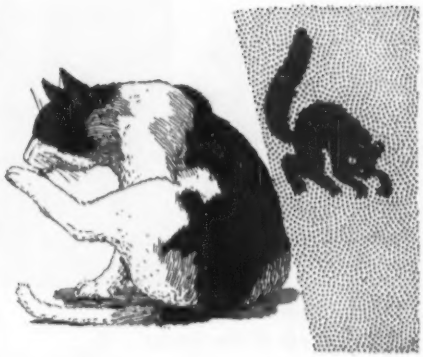
At twelve or thirteen thousand feet the pika of western United States has little to fear from the occasional summer visitor who hikes up to his windswept home. Anyone who seeks out such high places is likely to be a lover of Nature, interested in observing the creatures of the mountains and with no intent to harm them. It is fascinating to watch our little pika, or cony, as it is also called, busily storing the food that will see it through the severe winter of high western mountains. But at nine or ten thousand feet in Mexico there are permanent villages. Cattlemen harvest the zacatón to thatch their crude homes, or fuel gatherers tramp with back-breaking loads of wood across the grassy runways of zacatuche. Sleek weasels and, perhaps, the gray fox search out and prey upon the animal. But it is from "Sunday" hunters that the interesting little animal has most to fear. Not true sportsmen, these men, like some of their fellows in the United States, kill whatever comes before the gun simply for the joy of destruction. The natives who live in the region do not kill the volcano rabbit even to extend their meager diet of tortillas and beans. The animal's favorite food is an aromatic herb called *Cunita tritifolium*, which possibly gives an odor to the flesh and makes it unpalatable. This plant forms such dense thickets that it is probably important to the zacatuche as a place of refuge as well as for food.

The home of zacatuche is a region of heavy summer rains, with snows at higher altitudes. Winters are dry. Occasionally during the winter, "northers" blow up, blanketing the zacatón for two or three days in drizzily fog. But on clear days the majestic cones of the sleeping volcanoes, Popocatépetl and Iztaccíhuatl, stand guard over the valley of Mexico. Between them lies the pass of Cortés, from which the conqueror in 1519 looked down for the first time at the Aztec capital. Neither summer rains nor winter drought, Spanish conquerors nor "Sunday" hunters have had any pronounced effect upon zacatuche. Mammalogists call him a relict of the ancient animals that once shared his mountain home. Perhaps his success as a species lies not so much within himself, but is due rather to the thick bunch grasses and herbs of the zacatón, among the coarse stems of which he finds protection from his predators, a safe place to rear his young, and ample food to nourish his body.

HALLOWEEN:

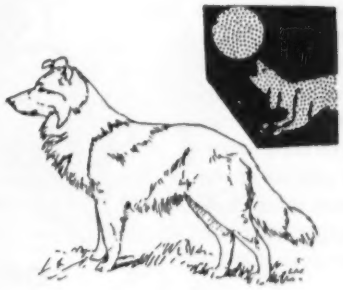
Its Natural and Unnatural History

By E. LAURENCE PALMER

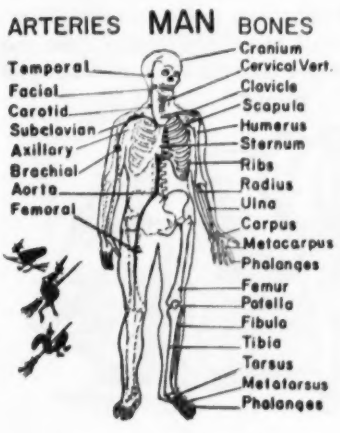


This is the eighty-third in NATURE MAGAZINE'S *series of educational inserts.*

HALLOWEEN is a time in the year when we can do absurd things without danger to our reputations. Then dignity may bob for apples, beauty put on an incongruous mask, age play-act like goblins and intelligence be utterly frivolous. So we choose to suggest how we may enjoy Halloween's absurdity and yet learn something; eat our cake and have it. We have no wish to rob anyone of a single shiver at the thought of a ghost, providing neither is taken seriously. Maybe a skeleton may scare you, but you can learn something about yourself from it. Maybe a bat may frighten you, but you should know of its usefulness. Possibly an owl's hoot may thrill you, but you should know what it means to other owls, and to other forms of wildlife. Werewolves may be common in your stable of nightmares, but your vote may determine the fate of wolves that represent, in their right place, a glorious segment of Nature. Whitaker Chambers may have thought of the nursery rhyme about Peter who hid his wife in a pumpkin shell, and there kept her very well, when he hid the Hiss papers.

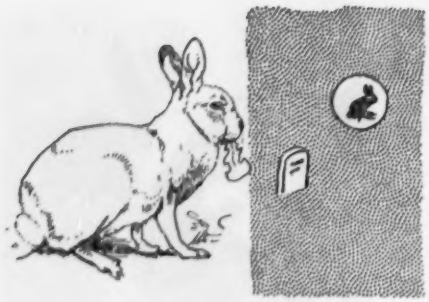


This special insert is different from any other in our series. Instead of giving reasonably detailed, known facts about the units of Nature considered, it approaches the subjects by considering the role these organisms play on Halloween night. So we will not discuss the cat as a carcass on a laboratory table, as an enemy of quail, or as a pet beside the radiator. Instead, we consider the cat, as some people do, for its association with witches, luck and moonlight on a back fence.



We like Halloween tremendously. Particularly we enjoy little boys and girls who come to our door, dressed as though they were very important and able, for once, to tell us what we should do—or else. We return courtesy for their seeming discourtesy rather than as loot for their threats, and, since no one takes it seriously, we all have a good time about it. We give them nuts and apples. We have a pumpkin jack-o-lantern to match theirs. We have paper bats, cats and ghosts decorating our windows and walls, and we try to enter into the spirit of the spirits of the time, and of the sprites who keep our front doorbell ringing.

This year we will miss our usual Halloween parties because, instead of thinking of the moon as something mystic, we thought of it in another way. We like to collect shells. They can be found best when the tide is exceptionally low. Our "California-Mexico Tide Tables for 1955," issued by the Standard Oil Company of California, tells us that, on Halloween, at our favorite collecting spot at Guaymas, Mexico, there will be a subzero tide at 4:19 P.M. And a full moon should light the sky by the time the sun sets, so the collecting period may be a long one. I can look forward to a Halloween evening following a strenuous collecting trip, with a long trudge down the beach loaded with shells collected by my wife while a full moon lights the sky. We may amuse ourselves by thinking of witches, ghosts and gnomes, because we find fun in doing this. But we will have used our knowledge of the moon to make the most of our professional hobby. There is not the slightest doubt that the passing thoughts about the "little folk" that haunt the shadows will serve to make us forget tired bones, soaked clothing and some of the food that we will be forced to eat before we



RABBIT

get back north of the border.

So this is written in the hope that you may use this, and the previous inserts, to understand the natural history of the real units of Nature about which so much unnatural history is attractively available on Halloween. If only everyone who thinks about bats, draws bats, or uses bats in the season's decorations could begin next month by really appreciating bats. If they would, what progress we would make and how much happier we and the bats would be in enjoying our coexistence on this earth. We bow to prejudices in our chart section, this time, and consider the popular role of bats on Halloween. We ask in return that you read the last section of the chart dealing with bats, or the earlier insert where bats were more adequately considered, or better yet, that you get acquainted with a few bats if they are available for study. Forget your prejudices and you will like the bats, I am sure. This philosophy may well be applied to other things, of course, and if we can get you to enjoy something that you previously disliked or feared, you and I will both be much happier.

RAVEN

Last night I took my peppy fox terrier down to a neighbor's house to see my neighbors and their three-year-old son. When the boy and the terrier first came together there was doubt on both sides as to what might be expected. Each was obviously frightened by the other. Both questioned, I think, the cordial approach of the stranger. With no difficulty at all we could have magnified that temporary antipathy between two potential friends, and thus ruined an evening. Instead, we adults sat down with boy and dog and brought them together on an understanding basis. The boy was told not to be too rough with the pup, and the pup was induced to let the boy rub him affectionately. Once the curtain of distrust had been parted, things went along splendidly. In a few moments both little animals were rolling on the floor, having a wonderful time. When the time came to leave it was obvious that a friendship had been established that was truly worth while. The alternative possibilities of such encounter do not have to be elaborated.

I could not help but wonder, after this experience with a pup and a youngster, if some similar understanding might not be effected between many humans and things in Nature for which they seem to have developed resentment. For years I taught students to handle, to appreciate, and even to love snakes. It was not always easy, but I know of no single case where it was not worth while, although I know of plenty of times when I was not successful. Why can we not, this Halloween, set out to try to make people understand cats, bats, skeletons, howling dogs, moons and pumpkins? Why scare a child with a paper bat and then expect him to grow up enjoying these most useful creatures? Why not strive for understanding on the part of all concerned?

We use paper and imitation skeletons to scare folks on Halloween night; why not, while we are at it, learn to name a few of the bones of that skeleton? At our Halloween party we may have a "witch" read our palms, but why press folks into believing that their future is predicated on differences in the lines of their hands, or by the shape of their hands. Watch your television when musical programs are under way. Observe the hands of some of the professional pianists and ask yourself if those hands look as though they were made to get music by tickling piano keys. Look at some of the hands of your attractive friends and see if you think the way they look to you has much, if any, indication of the ability of those hands to do different things. I have a book on palmistry beside me as I write this, and I remember a pianist I saw last night on television. If anyone can reconcile what the book says with what I saw he has real imagination. It was once my lot to be selected from a group to have my head "read" by a visiting professional phrenologist. He was right in his interpretations by about ten percent, and history has proved that, but we all had a lot of fun listening to the man, and none of us took it seriously. I do hope the time never comes when I cannot, for the fun of it, "consult" a palmist or a phrenologist. However, I am afraid I shall never take one of them too seriously, any more than I take the standard reading of

OWL

WOLF

my character by an astrologer. Do not bar palm reading from your Halloween party, but if you take it seriously be really sure that you are satisfied with the validity of the basic evidence used. Look for the "life lines" on the palms of those at the next party made up of folks of varying ages, and check what you see with what you are told by the palmistry books. Do not take my word, or the word of anyone, on this. Just test what you are told and come to your own conclusion.

Do not forget wholly the fun of Halloween and similar events. One can pity the person who can have no fun as much as one can pity the person who thinks nothing but fun has value. Do not forget, also, that Halloween, historically, has some religious significance. In short, try to be a well-rounded person finding intelligent satisfaction in many aspects of human experience. Make believe that you are scared at the jack-o-lantern on the head of a six-year-old neighbor, and do not get annoyed at him for ringing your door bell one night in the year even though you are busy. Shiver when you hear an owl, but think of the harmful mice the bird may destroy. Dream about a werewolf, if you must, but wake up soon and grin over the fact that it was merely a dream—if you can. I sometimes find this difficult. Read Poe's "Raven" some dark, windy night when you are at home alone, with the wind blowing outside and just one light on in the house, and that a small one. Then look over your library and read "Silverspot" in Seton's *Wild Animals I Have Known*. Do not pass up Poe, but do not let him set the whole pattern for your life.

APPLE

HAWTHORN

Halloween in England is known as All Hallow's Eve, or the evening before All Saints' Day. Of course, it has an origin far back in antiquity, when we compare it with our modern Thanksgiving Day, for example. Both, however, are associated with harvest time. The Roman festival of Pomona, dedicated to the goddess of fruit, is in part responsible for the extent to which fruits such as apples, nuts and the like figure in the festivities. Halloween also dates back to the last of the three annual festivals celebrated by the pagan priests of Britain, or the Druids. In England and Scotland, this celebration has long been associated with parties of a frivolous nature, frequently directed, facetiously or otherwise, to divining a future sweetheart. Most of these long-established customs find some representation in the modern activities associated with the event.

BROOM CORN

The establishment of a sensible attitude toward Halloween may call for some of your best diplomatic behavior. You will have to match wits with those who have the most stubborn of prejudices. Many of these persons will have been conditioned by fears of long standing; fears that found their roots in the teachings of those whom they must have inherently respected. It is frequently easier to play on fears than on reason, and while known things can be met head on with convincing arguments, unknown things may be as elusive as a shadow when subject of an argument.

BITTERSWEET

BARBERRY

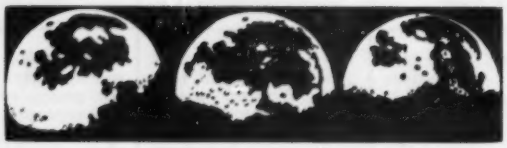
Of course, there are those who believe inplicitly in ghosts, spooks, and hexing; in evil eyes and the like. For most of us these lack validity, but for most of us this Halloween there will come the opportunity to help some younger person chart a life course that we believe will be more satisfying if it rests on fact with the fanciful aspects being relegated to a recreational role. I would be the last one to suggest that all reference to fanciful things be banished from life. I know too many unhappy people who hold that attitude. A good ghost story well told, a visit from good old Saint Nick, a few imaginative trips on a broomstick behind a witch on a moonlight night have at times provided too much fun and satisfaction to me to deny similar vicarious experiences to others. Last summer my wife and I visited an old castle in England. It was identified with her ancestry. We have found difficulty ever since in deciding (*continued on page 480*)

SUBJECT	CATS	DOGS	BAT	WOLF
POPULAR SETTING	The 81st insert of this series was devoted wholly to cats. Cats, particularly black cats, are reputed to be associated with evil spirits, or to be the residence of evil spirits. They are reputed to bring bad luck, particularly if they cross our paths. They share this quality with the shrews. Usually at their worst they are pictured silhouetted against the moon while perched on a fence, with swollen tail, arched back and glaring eyes. Snarling, spitting and caterwauling commonly contributes to their unpopularity with many persons.	The 64th insert of this series was devoted wholly to dogs. Howling dogs are reputed to be associated with death, or the imminence of death. One book lists nearly 200 sayings supposedly based on dog behavior. "One barking dog sets the street to barking" is an example. Another contends that the last pup born in a litter is the best. Maximum respect for a man is expressed in the saying that a man "honors the very fleas of his neighbor's dog." Howling dogs, at their worst, are pictured howling at a full moon.	The 66th insert in this series elaborated on bats. Geographically bats vary in their significance to man. In some parts of the world they are considered as symbols of good luck. They are falsely reputed to try to get into one's hair. While they may have body parasites, these do not favor human blood. Like wolves, cats and some other animals, they are reputed to be the residence of evil spirits. The vampire is reputed even to take on human form at will, falsely, of course.	Possibly the most diabolic creation of superstitious man is the werewolf, a creature that can change at will from human to wolf and back; a creature that is tirelessly persistent, patient and vindictive; a fictitious being that cannot be killed and is forever biding its time to destroy its victim. In short, it is a villainous nightmare capable of being as bad as or worse than any of the heinous symbols of Halloween. It is as deceitful as a "wolf in sheep's clothing." Of course, the term "wolf" has many other less hateful associations.
SETTING IN LITERATURE	Legends about cats have been built through stories such as the "Owl and the Pussy Cat," "Puss-in-Boots," the kittens who lost their mittens, Dick Whittington's cat, and "I Like Little Pussy." Cats were worshipped in the Nile region, damned and roasted alive when witchcraft was common, loved, hated, petted, abused, protected, hunted as vermin, abandoned, bred, used in medical research and otherwise treated by man.	One of the best references indicating a close friendliness for a child with a dog is found in "Puppy and I," appearing in A.A. Milne's masterpiece, "When We Were Very Young." Unprofitable avarice is expressed in the legend of the dog who dropped the meat he carried to take meat from another dog that was only his shadow. Kipling, in his "Just-so Stories," held that the dog became domesticated before "The Cat That Walked by Himself."	There is little popular literature likely to make one consider a bat as a desirable animal. The expression "bats in your belfry" implies insanity, and one who is considered as "batty" obviously is not normal. Goldsmith, in "The Deserted Village," used bats to create a desolate atmosphere, and Shakespeare uses them similarly in "Macbeth" and slightly differently in "The Tempest."	Legends have grown up about wolves, and wolves have had records that made them legendary. Imaginative stories have done much to modify man's opinion of the wolf. Kipling in his "Jungle Books" used a mother wolf as a friend of a lost boy. Seton in his "Lobo," London in his "Call of the Wild," Baron Munchausen in his "Adventures," and the average imaginative writer of frontier days have created impossible concepts of wolves.
LIFE HISTORY	Domestic cats may weigh to 17 pounds, measure 19 inches exclusive of an 11-inch tail. They are variously colored, but black cats usually have clear yellow eyes and some white under chin and at tail tip. They may live to 31 years, breeding usually from age 10 months to 14 years. Litters of 8 or more kittens are born 56-65 days after mating. Young, blind for 10 days, develop milk teeth from 4-35 days and permanent teeth begin at 4 months.	Dogs vary in length from 7 inches to 5 feet. Their toes are not retractile like those of cats. Their canine teeth are thicker and shorter proportionately than those of cats and foxes. 6 to 12 puppies are born 59-63 days after the mating. The pups are blind and deaf from 10-12 days, nurse until about 8 weeks, and biologically able to breed at 1 year. Life span may be to 20 years, but usually shorter.	Most bats of our temperate regions feed wholly on insects, taken on the wing, and are therefore of great value. The little brown bat mates promiscuously in the fall, with fertilization delayed until spring. The young nurse for three weeks, fly at three weeks. Females breed at 10 months, males at 14 months. Detect food in flight by radar-like sensitivity to sounds unheard by humans.	A male wolf may measure 64 inches and weigh to 150 pounds; a female, 56 inches and 80 pounds. Each is gray, sprinkled with black, has slant eyes, sharp muzzle, curved canine teeth and ears smaller than those of the related coyote. 3-13 pups are born 63 days after the mating, are blind about 9 days and suckled for two months. The family may run as a pack for a year. Life span may be 15 years.
REAL VALUE	Cats have value as mouse and rat destroyers and may be bred for this purpose. They are disease carriers, great bird destroyers, often excellent companions. Not recognized in literature as are dogs and horses.	Dogs have superior value as companions, as hunters, as watch dogs, as pack animals over difficult terrain, as experimental animals in medical research. They may carry dangerous diseases, but may save many lives.	Obviously valuable insect destroyers. Manure accumulates in hibernation caves as guano and has value as fertilizer. May have 100-mile-diameter home range, and may live to 10 years, at least.	Wolves serve to keep smaller or weaker animals reduced in numbers; may be enemies of stock, particularly young horses; are probably extinct in most of United States except Michigan and Wisconsin.

RABBIT	OWL	RAVEN	TOADS	MAN
The 7th special insert in this series considered rabbits. Superstitious folk associate rabbits with graveyards and ghosts, and feel that a rabbit's foot, properly rubbed, may protect the holder from dire consequences. To make them handy, rabbits' feet are sometimes used as watch fobs. Their use as ghost repellents compares with the preventive chewing of chicken feathers where voodooism holds sway. Possibly because of their assumed association with spooks they are avoided by some under some circumstances.	The 19th insert in this series dealt with owls. In popular concept, owls are endowed with great wisdom, yet many fear them and their calls. In the "Comedy of Errors" we read "This is the fairy-land; O spite of spites! We talk with goblins, owls and sprites," and in "The Tempest" it is: "There I crouch when owls do cry. On the bat's back I do fly." Obviously this is good Halloween atmosphere. The relatively large eyes of owls usually serve to create a mysterious effect emphasized in Halloween symbols.	Possibly no writing compares favorably with Edgar Allen Poe's "The Raven" in producing the synthetic shivers considered as desirable on a Halloween party. This, of course, does not refer to the effect of the poem on children, who might be expected to go to sleep in the midst of its reading. Ravens are reputed to have mysterious significance, even the British protecting the ravens near London Bridge because they say as long as the ravens are there England will stand. Possibly cause and effect is confused here.	The 30th insert of this series dealt with toads and their relatives. They are not too closely identified with the Halloween season because by that time they have, over the northern part of their range, gone into hibernation. However, they do figure prominently among the animals about which we have fixed superstitions. On a recent quiz program, a woman refused to handle a toad even when promised a long, paid-up journey if she could make it give her a wart, and even though she said that she knew how to cure warts.	The 7th insert of this series gave the story of man. Apparently the more primitive the people the more likely are they to consider seriously the mystic world, giving human form to mystical concepts or mystic powers to man himself. Fairies, pixies, gremlins, brownies, the "little folk" and Santa Claus are most likely to refer to kindly creatures of the imaginative spirit world. Duppies, bogies, goblins, ogres, devils, giant, leprechauns, sirens, mermaids and banshees may bode ill for man.
Rabbits have established popularity with most persons, partly because they have been favorably conditioned by such fictitious characters as Brer Rabbit in the Uncle Remus stories, Peter Rabbit and Molly Cottontail, Raggylug of Seton, Bugs Bunny of the cartoons, Uncle Wiggly of the newspaper columns, and, eventually, by that lovable character, "Harvey," of the theatre. These frequently distort the true picture.	Children learn about owls through hearing of "The Owl and the Pussy Cat," or, more delightfully, in what A. A. Milne tells about the adventures of Wol in the "Winnie the Pooh" verses. Most stories may touch on the silent flight of owls, and upon their living in holes, including the "Wise old owl" who "lived in an oak. The more he saw the less he spoke. The less he spoke, the more he heard. Why aren't we all more like this bird?"	Children may well be conditioned unfavorably to ravens by Walt Disney's representation of a raven as the spirit of evil in "Snow White and the Seven Dwarfs." It is unfortunate that the raven there was so effective in introducing a sour note into an otherwise delightful story. Sam Scoville's "The Raven's Nest," portraying his quest of a raven's nest in Pennsylvania, should be read as an antidote for Poe and the Snow White story.	Many fairy stories available to children deal with toads, usually to the detriment of the reputation of these useful animals. Youthful royalty may be turned into toads by vengeful witches, only to be freed by kindness of some good person. In one story of toads and diamonds a "bad little girl" was punished for discourtesies to an old lady by having toads jump from her mouth every time she spoke. Result, great unhappiness.	Ghosts, spooks and witches rank high in the frightening aspects of Halloween, which now we fortunately do not take seriously. Hamlet's ghost, Macbeth's witches and the headless horseman give readers vicarious chills. More dynamic and serious to some are what we get from witch doctors, and those who practice voodoo, obeah and hexing. On the periphery of this mystic side of man comes belief in palmistry, phrenology and astrology.
In popular literature the term rabbit is used to cover both hares and rabbits. Young hares are born more fully developed than are young rabbits. They are well furred, their eyes are soon open and they can move about more quickly than do young rabbits. Both are usually polygamous, producing a number of large litters a year. They are fair game for most predators. They may develop large populations and suffer from diseases.	We consider the screech owl, a bird that measures 10 inches in length, weighs 5-6 ounces, is found in a red or a gray phase. The nest is in a hollow in a tree and is unlined. 3-7 eggs hatch in about 3 weeks after incubation by one or both parents. There is one annual brood and the food is primarily insects, although it may include many mice, some small birds, frogs, earthworms and salamanders and, rarely, poultry.	Ravens have a length of to 26 inches as compared with 21 in a crow. The raven's tail in flight appears more rounded than that of a crow. Ravens build a coarse twig nest in a tall tree, or on a cliff. The 5-7 eggs hatch in about 3 weeks, with both sexes incubating. There is one annual brood. The food is largely insects, mice and rats, though they have been known to kill small lambs. Ravens work cooperatively.	Toads do not give warts, although some can give off a substance most offensive to dogs and irritating if rubbed into human eyes. The common toad mates in the spring, with the male giving a prolonged high-pitched trill at breeding time. The eggs are laid in strings, hatch into small, black tadpoles that serve as scavengers and after about 2 months transform into little toads that come out of ponds; do not rain into them.	As an animal man is born 9 months after the mating, matures sexually in the 2nd decade and has a life expectancy constantly lengthening because of ability to understand disease, willingness, individually and collectively, to fight it and the basic will to make the most of life for individual and social good. Most progress has and will develop through linking the products of imagination and intelligent work.
Rabbits and hares generally are destroyers of plants needed by man and by his domestic animals. Attempts to control them by introduction of epidemic diseases have sometimes gotten out of hand. Popular game species.	Screech owls are essentially useful. Our most useful owls are the barn owls, which feed almost exclusively on rats and mice, a family requiring to 100 a day. Long-eared owls also rank high in value.	Ravens usually are considered as useful scavengers. Poe's attributed intelligence has not resulted in their holding their original territory as well as have crows. In spite of this, Poe's "Raven" is wonderful.	Toads as adults are most useful as destroyers of insects and slugs that attack garden plants. They may also destroy useful earthworms. The normal person's reaction to toads should be highly favorable.	Man, through his ability to control his own environment and to discipline himself and the forces of nature, can master the world, and possibly himself, if he accepts the responsibility with his ability.

SUBJECT	PUMPKIN	APPLES	BROOM CORN	WITCHES' BROOM
POPULAR SETTING	The 18th insert of this series dealt with pumpkins. Pumpkins are featured at Halloween and Thanksgiving time. Made into jack-o-lanterns, they vary from crude, candle-lit devices designed to be carried on the head or left in a window, to pumpkins lighted by electric lights that can be turned on and off at a distance with startling results. It is ridiculous to expect a jack-o-lantern made of a pumpkin to scare human beings, who as a group have rejected belief in witches, ghosts and similar figments of the imagination.	The 16th special insert of this series dealt with apples. A standard Halloween game calls for "bobbing" for apples floating in a tub of water while ones hands are tied behind the back. Put on a competitive basis, this yields an abundance of appropriate fun. Similarly, apples hung on strings at mouth level and eaten by competitors of opposite sexes provide merriment, but little nourishment. The standard Halloween party refreshment is apple cider, and apples are used as ornaments and in satisfying "tricks or treats" penalties.	The 31st of this series of inserts dealt with corn. Corn ranks high in the story of Halloween, whether we consider the broomcorn broom on which the witches are supposed to ride, or the more realistic corn stalks that provide an abundant, quick decoration to produce an outdoor atmosphere indoors. Popcorn is relatively common in Halloween snacks, and ears of corn make good and appropriate wall decorations. Of course, popcorn does not come from broomcorn, but for that matter the brooms of witches are made from whimsey not from corn.	This subject has not been touched on previously in these inserts. There is a natural creation properly known as witches' broom, but of course not used by witches. Trees such as elms and hackberries often have witches' brooms in abundance on them. They appear as broom-like clusters of twigs, usually near the ends of branches, and are most abundant in our middle West, although they are found elsewhere. Similar growths may be found on many kinds of cherries and plums, and on other trees and shrubs.
SETTING IN LITERATURE	Children are started early to think of pumpkins as containers. Peter, Peter found a pumpkin-shell in which he kept his wife very well. Cinderella rode to the ball in a magic pumpkin coach drawn by mouse-horses. Much later we learned of the use of pumpkins to hide the famous papers that sent Hiss to jail. It remained for the poet Riley to use pumpkins as a symbol of autumn with his "When the frost is on the pumpkin."	The mere fact that apples are not too closely identified with the possibly unpleasant ghosts and spooks of Halloween may be taken as evidence that they are just too good to be the targets of suspicion. An apple a day may keep the doctor away, but hard cider and applejack may bring him back again. Apples creep into homely expressions such as the "apple of his eye," "applesauce" and "apple-cheeked," and into the William Tell story.	Just as Riley made pumpkins a factor in the autumn scene, so he added corn when he wrote, "When the frost is on the pumpkin and the fodder's in the shock." Brooms enter into such sayings as the proverb "A new broom sweepeth cleane" a saying frequently taken seriously by newly elected politicians. Swift, in his "Meditation upon a Broomstick," said "Surely man is a broomstick," but that might be controversial.	Since this subject has not been treated elsewhere in the inserts we elect to stick more closely to our subject here than in most of the other cases. The witches' broom of our trees is usually caused by a fungus that attacks the bark and wood of the host plants, stimulating bud growth and causing the deformity. Some witches' brooms are caused by mites and by fungi. The fungus is usually an *Exoascus*.
LIFE HISTORY	Pumpkins are native of America, where they have been cultivated since 1500 B.C. They are grown in hills, frequently jointly with corn. They are closely related to squashes, cucumbers, gourds and canteloupes, and should not be grown too closely to some of these. 1 pound of pulp of the rind yields about 180 food calories. About one-half the purchased weight is usable as food by man. In oriental countries the seeds are roasted and eaten as delicacies.	Apples are native of Europe and Asia but widely cultivated in temperate parts of the world. Johnny Appleseed was reputed to have done much to spread apples over early American settlements. Fruits are rich in vitamins B and C. New orchards may bear in 4 years. At maturity, yield may be to 500 bushels of fruit to the acre. Sprays, suitable storage, careful harvest and wrapping increase market values.	Broom corn is a native of tropical Asia and Africa, while the corn we eat is native of America. It is most closely related to sorghum, durra and kaffir corn, Sudan grass and Johnson grass, all of which are in the genus *Holcus*, while our edible corn is in the genus *Zea*. Obviously, then, we took enormous and possibly unjustified license in the first section above. This may be excusable, we hope.	Witches' broom fungus may live in the wood of the infected tree from year to year. Leaves developing in the infected area may develop a whitish under-surface after falling to the ground, and this may serve to spread the disease to uninfected plants. Some degree of control may be effected by burning leaves of plants under infected trees, although this does not control the fungus in the wood.
REAL VALUE	Pumpkins are stored at 50-60°F., or frozen for use in pies. There are those who contend that bakery-made pies are pumpkin pies while home made pies are punkin pies, but we will not try to define the differences.	Apples are a major fruit crop in the United States, producing fruits sold fresh in the market, canned as apple sauce, cider, vinegar, valuable charcoal, superior fuel, welcome shade and beauty.	In the 31st insert we gave the factual story of broom corn, and this apparently has little to do with witches or their brooms. This may again only point up some of the absurdities of Halloween natural history.	Witches' broom on fruit trees may ruin branches for fruit growing, and where this is the case control may have to be severe and continual, otherwise the crop loss may be serious.

BITTERSWEET	MAY TREE	BUTTERNUTS	BAYBERRY	THE NIGHT SKY, OCTOBER 31, 1955
There is little mysticism associated with bittersweet, but many of the plants are used in Halloween decorations. This justifies inclusion in this treatment. The plant is *Celastrus scandens*, a weak, woody vine that climbs and twines over trees and shrubs. A plant may reach a length of to 30 feet, or even more. The twigs are a yellowish-green to brown, and commonly winterkill at the tips. The leaves are alternate, more or less 2-ranked, to 4 inches long and half that in width, smooth on both sides and pointed.	The nursery jingle tells us "Here we go gathering nuts and may, but usually it is changed to nuts "in May." This is even too absurd for Halloween unnatural history, so we elect to adhere to the original text. The "may" referred to in the jingle is the may-tree, a member of the genus *Crataegus* to which our common thorn-apple belongs and of which there are a most confusing series of close relatives. Of course, the may was collected for home ornament and was taken as incidental to a nut-collecting jaunt.	The 11th special insert in this series dealt with nuts. We elect to consider butternuts as representative of the nuts because so frequently they constituted a substantial part of the Halloween feasts in the early days. The species popular for this purpose at Halloween time will vary greatly in different parts of the country, but are probably considered in the 11th insert. Our dictionary gives 24 different definitions of the word nut. At least one is significant here.	Since candles are used so frequently in Halloween games and pranks it is appropriate to consider here at least one plant useful in making candles. Possibly the most famous of American plant sources for candles is the bayberry, or wax myrtle. The myrtle warbler gets its name from the habit it has of feeding on the fruits of this plant. Candles, of course, are popular in many mystic rituals of religious, fraternal and other organizations. Candle-lighting ceremonies are effective, particularly with great crowds.	Halloween's night sky should provide an ideal setting for Halloween, realistically or mystically. There should be a full moon. At Guaymas, Mexico, where the writer hopes to be, there will be a subzero tide at 4:19 P.M., sunset at 6:31 P.M., moonrise at 5:23 P.M., a superb beach, a shell-crazy wife. Nuf sed. If the stars can be seen you may understand them with the help of special inserts 3, 29 and 36. We hope that wherever you may be watching birds cross the moon, shell-hunting or ghost-chasing, you will enjoy the night.
Bittersweet ranges from Quebec to North Carolina and west to New Mexico and Manitoba. There are some 30 species in the genus, some living in tropical America. This is the only species in temperate North America. The plant is conspicuous in fall and winter, when the fruits burst showing characteristic red and yellow clusters with each fruit to ½-inch in diameter. The twining vines may kill trees.	A few, but not many, of the native *Crataegus* species yield fruits that are edible. Medsger, in his book on edible plants, says that there are twenty species of hawthorns or thornapples, which are our native may-trees that produce edible fruits. Some of these produce early fruits that may be made into jellies, but most ripen late in the season. Some are edible if eaten raw, but the large pits make nibbling necessary.	The female counterpart of the Egyptian god Nu was Nut, the consort of Geb, the earth. Her winged image was frequently painted on coffins and because of this might well be considered during an evening devoted to ghosts, spooks, skeletons and other concepts and realities designed to stimulate fright, either real or simulated. Of course, too, the term nut applied to crazy folks might be applied to pranksters.	Romeo and Juliet remind us of how far candle-light may be seen and imply a moral that is at least thought-provoking. One poet sees "bees' hymns in wax candles," assuming that while the candle burns she can see back and hear the hum of bees that collect the wax used in the candle. Unfortunately most of our modern candles are the product or by-product of the oil industry. Even the tallow candle is gone.	We elect to emphasize the moon as the most important element of this Halloween's night sky. Moonlight has a real, or at least imagined effect on romance, crime, growing crops and other activities. Some of these may be as real as the effect of the moon on the tides. Others may mask behavior or be as whimsical as a "Midsummer Night's Dream." On a night like this it may be easy to imagine ghosts, goblins, or witches.
Some bittersweet plants bear only stamens and then, of course, do not bear fruits. Other plants may bear both stamens and pistils. Reproduction may be made by cuttings, being careful not to make cuttings from plants that bear only stamens. Some plants have variegated leaves, which to a small degree enhance their ornamental and, of course, sale value. Close relatives include the burning bush.	*Crataegus*, in one species or another, are found from coast to coast. Some are attractive because of their flowers, but others bear flowers that yield an atrocious odor that smells like rotten meat. The genus is a member of the rose family, and the fruits resemble rose hips or apples at times. The fruits may be red in some species and yellow in others. Most of the thornapples bear villainous spines.	In the realm of reality butternuts are borne on trees that reach a height of to 100 feet. They are found from New Brunswick to Quebec and Minnesota, and south to Georgia and Arkansas. They grow in rich soil, commonly at higher elevations than the related black walnuts. The wood is lighter and softer than that of the popular black walnut. The sap yields a sugar, and has been added to maple sap in making sugar.	Bayberry, the elixir of candle producers, grows in swamps and wet woodlands from New Jersey to Florida, west to Texas and Arkansas and in the West Indies. It may be at its best in the New England area. The blue, wax-covered fruits are boiled and the melted wax skimmed off and poured into moulds. When the candle burns it gives off a delightful fragrance. Two species, *Myrica cerifera* and *M. carolinensis*, are used.	To help you understand the moon we give you a picture. If you understand the phases of the moon you may be able to tell direction if you become lost. If you plan an expensive seashore trip and know the moon you can be sure that you land where you wish at the right time. In spite of all the excitement about space ships, it is doubtful if any person now living will make a round trip to the moon and live to tell of it.
Bittersweet is rather closely related to other ornamental woody plants such as holly, black alder and bladdernut. Clusters of fruit-bearing twigs find a ready sale with florists.	May-trees are grown primarily for their ornamental values though some are used deliberately in hedges where their stout spines provide effective discouragement for trespassers.	Many uses of butternuts might be cited, including the pickling of the young nuts in vinegar, sugar and spice, the use of the roots in medicine, of the bark and husks in making a dye and of the meats in candy.	Probably more persons know bayberry as an attractive ornamental purchased in small bunches in a flower shop, or as an ornamental used in landscaping, than will ever see, buy or smell a bayberry candle.	We hope that this insert will damage the false concept that the wisest use of leisure is to waste it doing nothing of consequence. Enjoy your ghosts if you will but understand what is back of them all.



(*continued from page 475*)

which part of that most memorable day meant most to us. Was it the part identified with history and the fights between the Scots and the English? Was it the distorted American history about George Washington, identified with the Washington coat of arms on the castle and wrongly identified by the English with our American history? Was it the romantic angle suggested between a man and a maid? Was it the story of fallen roofs caused by pilfered lead during a national military crisis? Or was it our search through dungeon and ruin for the two ghosts of the castle? Of course, we knew there were no ghosts, but I am glad I still could feel a thrilling chill when I explored alone in the dark the dungeon under that castle. I am glad that I am not too old and too rational to take that trip again next year, when we expect to return. I hope I can get the same thrill when I go on a hunt there for something I absolutely know, to my own satisfaction, does not exist. Possibly it is with the thought that I hope others can get this sort of satisfaction from Halloween that I elected to devote this insert to the subject. May you have many a thrill on the night of October 31, 1955. On the morning of November 1, 1955, may you really know something more about cats, bats, skeletons, howling dogs, owls, wolves, ravens, rabbit feet and men.

WITCH'S BROOM

BUTTERNUT

TOAD

We cannot here go into great detail on Halloween, Halloween history, Halloween parties and the like. I cannot give you the pros and cons of palmistry, the story of hexing, or the history of witchcraft. Instead, I will merely suggest a few books that may be useful to you should you wish to explore the subject farther.

From a rather considerable library of material useful in planning parties, I am sure that the one I know to be most useful for Halloween is *The Fun Encyclopedia* by E. O. Harbin, 1008 pages, published in 1940 by Abington-Cokesbury Press of New York City.

More modest in treatment and price, but of much help, is Dennison's *Bogie Book* of 36 pages published by Dennison's Manufacturing Company of Framingham, Massachusetts.

To help you investigate the field of palmistry, let me suggest that you read *How to Know People by Their Hands* by Josef Ranald, 144 pages, published in 1938 by Modern Age Books of New York City.

If you wish to study hexing a bit on the side read *Hex, No* by Alfred L. Shoemaker, 32 pages, published in 1953 by the Pennsylvania Dutch Folklore Center of Lancaster, Pennsylvania.

Any library will have a reasonable amount of literature on witchcraft, on ghosts and ghost stories and on superstitions so it should be unnecessary here to provide references.

It is quite probable that there are few fields of study that should offer greater opportunity for discovery than that of trying to find what local traditions regarding Halloween may be, and how these differ with those of other areas. I find in my community that there is always some confusion as to whether it should be celebrated on the night of the thirty-first or the first. Some even suggest that it should be observed on the preceding night. These may be young folk straining at the leash to get out and raise a little rumpus. Of course, as the years go by we have begun to show sense in some of these things. I would hate to think of what might happen to my place this Halloween if the neighborhood youngsters worked under the rules that were observed when I was their age. Certainly we now observe not only a more sane Fourth of July, but, also, a more sane Halloween.

One of the best evidences of our community having grown up is the practice of merchants to offer prizes to youngsters who will do the best job of decorating the store windows with soap drawings and the practice of having a Halloween parade under police supervision, where ingenuity gains at least some degree of public recognition and competition adds zest to the Halloween celebration.

In my own case, my early Halloween experiences have had some lasting effect. I used to enjoy fresh cabbage. One Halloween a group of us youngsters raided a neighborhood garden and I gorged myself on delicious cabbage. So completely did I do this that, to this day, more than a half century later, I cannot stand the smell of cabbage. Fortunately destruction of property, even of cabbages, seems to have gone out of style with the years. For this I am duly grateful. We are growing up.

Hunting and Fishing Survey

An Editorial

Every once in a while figures have been cited to show the amount of money spent annually in the United States by those who find recreation in hunting and fishing. Such statistics are intended, of course, to emphasize the economic importance of this sort of recreation, and, inversely, the economic significance of game hunted and fish fished. However, the figures given have been based on rather fragmentary evidence, guesswork, and, often, wishful thinking only.

At its 1954 meeting the International Association of Game, Fish and Conservation Commissioners adopted a resolution requesting the U. S. Fish and Wildlife Service to contract with a survey organization for a nationwide survey of the economics of hunting and sport fishing activities. This resolution has now been given effect. The Fish and Wildlife Service has signed such a contract with Crossley, S-D Surveys, Inc., and the study is scheduled to start January 1, 1956.

Funds to pay for this study—to the tune of $134,000—will come from the sum available to the Fish and Wildlife Service under the Pittman-Robertson and Dingell-Johnson Acts. These laws divert the income from the Federal excise tax on sporting arms and ammunition, and on fishing rods, reels, creels, and artificial lures, baits and flies, to finance the Federal aid fish and wildlife restoration programs, in cooperation with the States.

No national survey of this sort has ever been undertaken. A few States have tried to determine the economic significance of hunting and fishing, but their methods have varied and the data obtained have not contributed a clear national picture. Use of Federal aid funds for such a nationwide study seems a proper procedure. Certainly the economic aspects of hunting and fishing bear a close relationship to the numbers of game animals and sport fishes.

"State wildlife administrators," says the Fish and Wildlife announcement of the survey, "have long recognized the need for data on the economic status of hunting and fishing that they can use in planning their programs for the management of these natural resources. The Fish and Wildlife Service and other Federal agencies dealing with wildlife, as well as numerous private conservation organizations, will also benefit from the results of such a survey, which will provide an authentic measurement of the national interest in hunting and fishing."

It seems to us that such a survey, however, will be incomplete if it is confined exclusively to hunting and fishing. There is a large segment of our population interested in the outdoors, and the creatures in it, without any desire to kill anything. The Fish and Wildlife Service's own figures, for example, show that more than half of the visitor-days of use of the wildlife refuges are for camping, boating, picnicking, photography, observation of wildlife and similar non-consumptive uses. Such people also spend a lot of money to satisfy their interest, burn a lot of gasoline, wear rubber off many automobile tires, buy a lot of film and camping equipment, and otherwise contribute to the economy through their choice of outdoor experiences. As a criterion we know that there were close to five million visitors to the refuges in 1954—and the number is growing steadily—so the economic significance of those not hunting or fishing should not be ignored in assessing the economic attraction of wildlife resources.

Those forms of wildlife that are classed as "game" are not, therefore, exclusively of interest to people who wish to "harvest" them. This, it seems to us, should be recognized in any survey that lays claim to being complete.

There is often a tendency to feel overmuch solicitude for the gunner because he buys a license and spends money for arms and ammunition, and thus contributes tax money. Such solicitude could well be increased by the results of this survey, if it stresses too much the economic contribution of the users of rod and gun only. We have never been able to understand the claims of some gunners that they have some special rights to the wildlife by virtue of their taxes, licenses and expenditures made to indulge themselves in their favored recreation.

We trust, also, that the data obtained in this survey will not give aid and comfort to those who like to put a price tag on our outdoor resources. People get pleasure from outdoor experiences in various ways, but that pleasure cannot be reduced to dollars and cents—or should not be.

We shall await with interest the results of the hunting and fishing survey, which will be published by the Fish and Wildlife Service. We reiterate the hope that the study will be somewhat broader than apparently its original conception allowed, and it would seem that it should not be difficult to add a bit of data here and there to provide a more rounded picture. Wildlife resources are the property of the State, and therefore of the people. The people enjoy them in different ways and make economic contributions in so doing. The Fish and Wildlife Service could well keep this point in mind in administering this survey.

Tangles of barbed wire still line the sides of many washes.

From increasing numbers of signs come ominous warning to the traveler about the fate of the desert.

Scarcely a grove left unmarred, trunks of trees blackened and initialed.

Our Deserts Are Not Expendable

By HARRY C. JAMES

President, Desert Protective Council

"Peligro—Danger—Keep Out—Unexploded Shells—Unexploded Mines—Do Not Disturb Unfamiliar Objects—Closed to Public Entry."

From ever-increasing numbers of signs these ominous warnings give pause to the traveler on the highways of our southwestern deserts. They demonstrate all too well the fact that thousands of acres of desert land in every State of the Southwest have been preempted by the armed services and are now closed to the people whose heritage they are. Moreover, many of these areas will remain closed for the foreseeable future by reason of hazardous contamination.

To those of us who know something of the desert, and who have deep-seated affection for its great open sweeps, the past decade has brought dismay and apprehension. We have looked on, too unprotesting, while many of these eye-stretching vistas have fallen prey to the exploiter and developer.

Sub-divisions have sprung up here, there and everywhere; desert roads have been elaborated into highways; towns have evolved from jack-rabbit homesites—those five-acre plots surveyed out by the Federal government as a series of poor man's Palm Springs; distant springs have been developed and their waters piped afar, while wells have been sunk deeper and deeper into the constantly lowering water table. Often there is quite a race among salesmen to sell the last lot before the water table is pumped dry! This might be amusing if it were not so tragic—not only for the people who are buying the lots and building their homes, but also for the wildlife, whose scant water supply is thus appropriated. When the wells and the springs go dry the luckless purchaser can haul water or give up and move away, but long before that the birds and mammals dependent upon the original supply likely will have disappeared.

California's unique and beautiful native palms also are suffering from man's thoughtless, if not ruthless, encroachment. Scarcely a grove is left unmarred; their trunks blackened and initialed; their graceful skirts of dead fronds burned—victims of the fool who must see his name in a public place, and of the hedonist gratified by the sight of seeing a century of growth go up in flames.

The balance of Nature in the desert is a balance of great delicacy. Although desert plants and animals have developed adaptations to their environment that are

The restraints of "Danger—Peligro" are found in many desert areas, testifying to past and present uses of this region for military purposes.

A discarded gas mask bares its skull-like outline at the foot of a smoke tree, a symbol of the desert's fate.

a never-ending source of amazement, the fact remains that they do require certain minimal conditions if they are to survive. Water, food, refuge from enemies, shelter from winds and sun—these they must have, even as all of us, or they cease to exist.

The little night lizard is an excellent example of the threat to desert wildlife. It has a restricted habitat, living under rotted branches and trunks of prostrate dead Joshua trees. Thousands of these grotesque trees are now being uprooted and destroyed to clear lands for agricultural development, or for sub-dividing. Within the last few years great areas have been denuded of this largest of the lilies for the purpose of manufacturing from it a new type of wallboard. The desert night lizard, or yucca night lizard, as it is sometimes called, may well be in jeopardy if the destruction of the Joshua tree forests continues unabated.

Even the rocky territory of the chunky chuckawalla is being more and more restricted by man's invasion of the desert. The chuckawalla is not prolific, and it requires an environoment where there are cracks and crevices into which it can retreat and puff itself up into safety from the many predators—not least of them, man —that hunt him constantly.

Of the many forces that are endangering desert wildlife at the present time none is having a more devastating effect than the armed forces' reckless use of the desert lands under their control. Demand for additional land in every southwestern State is being made almost daily by Army, Navy, and Air Force, for the extension of present holdings, or for the establishment of new installations. Wildlife refuges seem specially marked for invasion.

Anza Desert State Park in California has lost a major portion of its original area, and the Navy continues to urge enlargement of its bombing range there. The Navy also has started proceedings to acquire about 900,000 acres of California's Saline Valley, one of the most spectacularly beautiful of the great desert valleys of the West, but, temporarily at least, has cancelled its request.

Almost all land north of US Highway 95, from Las Vegas to Goldfield, Nevada, is now under the authority of the armed services and the Atomic Energy Commission. As a consequence, safeguarding and efficient management of bighorn sheep, antelope, deer, quail, and other forms of wildlife in that extensive area are either decidedly restricted or definitely nonexistent. In some areas it approaches a situation that grants exclusive hunting rights to members of the armed forces!

In one section of a bighorn sheep refuge near Las Vegas the carcasses of eighteen desert bighorn were found. They had been shot and left to rot; this when that part of the refuge was within the Las Vegas Gunnery Range.

A resident of Antelope Valley, California, has written of his concern over the desert tortoise. He has picked up more than a thousand shells along highways and elsewhere, the animals that once inhabited them having been destroyed by both civilians and air force men. He reports finding a number of tortoises tied to clotheslines, their shells ragged from protracted attempts to free themselves. So great is this man's distress over this

unnecessary waste of wildlife that he is planning to buy ten acres on which to set up a sort of desert tortoise preserve!

Reports from quite another source—an air base in another part of the southern California desert—describe Air Force drivers of trucks and passenger cars going out of their way to drive over similar tortoises for the sadistic thrill of hearing them "pop." From a rancher in Oregon comes information of the practical extermination of a herd of antelope by aircraft strafing during the war years. Approval of such practises is inexcusable.

Stories of this kind are legion—many of them, of course, impossible to confirm. However, their very prevalence would indicate serious fire beneath the smoke of rumor.

Most persistent of the unverifiable stories is to the effect that, during his desert maneuvers, one general had his men scatter hundreds of pounds of poison grain around various installations in the training area, presumably to kill ground squirrels and other rodents that might be carrying disease-spreading parasites. The death toll of quail and other desert birds is said to have been appalling.

Recent personal exploration of this desert area between Desert Center and the Colorado River, where troops were trained for the North Africa campaign, gives credence to the tales of wildlife destruction—indeed, obliteration—by even the preparatory stratagems for a specialized type of warfare.

Wild "roads" radiate out in all directions over the arid stretches, beaten down to pavement hardness by tanks and trucks. Rough, rocky expanses had been leveled to the smoothness of city streets, as glassy in spots as the glacial polish on the high domes of Yosemite. Tangles of barbed wire still line the side of the washes. Tank treads have jammed cartridge cases among the great rock piles. A discarded gas mask bares its skull-like outline at the foot of a smoke tree.

It was April, but we saw not a single lizard; we heard not even one desert bird; we retraced no track of lizard, snake, or rodent. Life seemed to be taking an enforced holiday.

We recalled stories of how water-holes had been put out of use during this training era. The troops, as part of their conditioning for desert warfare, were required to subsist on very little water. To put in force this phase of training, a large number of water-holes were blasted out of use, and wells, springs, and seeps were cemented up. It is all too obvious what effect such action would have—or did have—on wildlife.

One must add a somewhat happier footnote to this. After the war the California Department of Fish and Game, and a few interested individuals, worked diligently to open up many of the seeps and to clean out wells and "tanks" that had been thus destroyed.

The desert-trained troops seem to have done a good job of cleaning up after themselves, so far as movable equipment and general litter are concerned. One drives along the highway in that area and sees little to remind him of the thousands of men that were stationed there. Occasional rows of neatly piled rocks are all that remain of a troop hospital or a headquarters camp. The army wiped the area clean of beer cans and other debris—but also of every vestige of wildlife!

One enheartening experience marked our days in that grim area. Wandering through the soundless wastes we came upon a *playa*, a sandy stretch several miles in extent, dotted with thousands of Mojave lilies in full bloom! It was Easter week, and this was resurrection indeed. Even the warlike tread of tank and truck had not been able to destroy the deeply rooted bulbs.

Dr. Edmund C. Jaeger, author of many books on the deserts of the Southwest, writes in confirmation of what happens to wildlife when the Army or Navy takes over an area. In a recent letter he says this in part: "Animal life, never plentiful in that [Patton] maneuver area, is now almost non-existent. It may be due to drought in part but not wholly by any means. . .One soldier told of how the men used to go out when they had free time, with revolvers and see how many chuckawallas they could kill. Smaller lizards were killed too 'just for fun and to have something to do.'. . .A man in Redlands told me that the last small band of antelope disappeared from Milpitas Wash when the Navy took over the ground east of the Chocolate Mts."

One is happy to be able to commend some commanding officers for wholehearted cooperation with conservationist attempts to safeguard desert wildlife and its environoment. Guy Fleming, former regional director of California state parks, always speaks with high praise of how General Joseph Stilwell worked with him in the days when Stilwell was conducting maneuvers back of San Diego. Officers of the Nellis Air Force Base in Nevada have been equally cooperative with conservation authorities in their area. In 1953, when a Marine Corps Artillery Training Base was established near Twentynine Palms, California, General Pepper requested an investigation of the area by the California Department of Fish and Game and the Fish and Wildlife Service to the end of formulating a plan for the protection of any bighorn sheep that might still be ranging in the Bullion Mountains.

But on the whole we have been (*continued on page 496*)

THE SHADOW

I saw a shadow on the wall,
I knew it was a lizard small,
And yet, the shadow made of him,
A monster large, and very grim.

He lifted up his little feet,
And crept along the garden seat,
So big his shadow on the wall,
He was a dragon — tail and all.

Huge claws replaced his tiny toes,
His tail lashed out at all his foes,
I half expected I would see
Him belching fire right out at me.
And then he ran from sun to shade,
So no more shadow then he made;
Again he was a lizard small,
The dragon hid behind the wall.

Edith Witherspoon

The sapsucker is braced by the stiff "W" of its tail and stretched backward before starting to drum.

Here the sapsucker hammers so rapidly that its head becomes blurred, almost invisible.

There is much to be seen when watching the

SAPSUCKER SUGARBUSH

By HARRIET BURKHART

Photographs by the author

ONE MORNING in early July I realized I had newcomers among the various woodpeckers constantly at work on my trees. It was a family of yellow-bellied sapsuckers. I also realized that this might constitute a breeding record for the species in this particular part of northwestern Pennsylvania, the area in Crawford County surrounding the little lake named for Canadohta, a Cornplanter chief. For there were several dull, obviously young, birds with the extremely colorful adults. I counted four of these immatures in view at one time, apparently being initiated into the art of sap-sucking.

Although I first glimpsed one of the young in a Norway maple, and occasionally saw one or more in other trees, the tree selected as the main feeder was a European white birch with graceful, pendulous branches. To my surprise, I found the trunk already well drilled up to where it branched, about five feet from the ground. The sap was running so freely that the white bark was wet and discolored. At first an adult was with two or three of the young, but soon the young birds came unescorted, one at a time, apparently no longer novices.

Especially welcome was the opportunity to see the fantastic sapsucker behavior I had read so much about, for the sapsucker is seldom seen here, except briefly in migration. In mid-April I had seen a female, with scarlet head patch but lacking the brilliant red on the throat of the male, feeding in the upper branches of the quaking aspens along the driveway. She stayed around the aspens at the edge of the woods for several days, and may have been preceded there by a male, as is usual in the migrations of sapsuckers. Apparently the pair disappeared into the woods to raise their brood; at least no sapsuckers were in evidence for several weeks. Both sexes share in the construction of the nest and the incubation of the eggs. All woodpecker eggs are pure white, protective coloration being unnecessary, and so transparent that the yolk of the fresh egg is plainly visible through the shell.

The painter who was working on my house feared for the tree and suggested hanging pieces of bright red cloth from some of the lower branches. I could see no point in this, as the birds would probably just move on up the tree and make new drills where I could not as easily observe and photograph them.

My time for the next few days, except for the inevitable household interruptions, was divided between

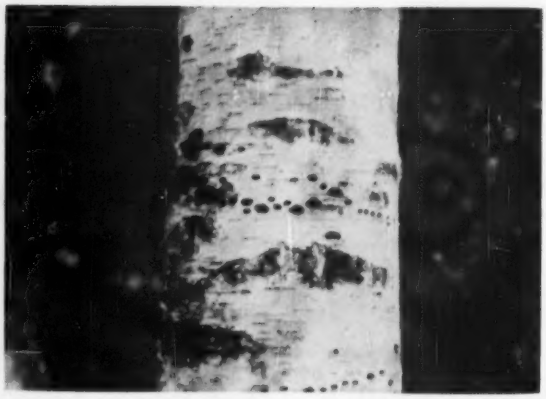
When the author would edge to within three or four feet of one of the birds it would lean back and peer at the camera a moment, then go back to feeding.

watching the sapsuckers and reading everything I could find about them in my reference books. All sorts of unexpected and exciting things were going on in that one tree. First to discover the little flowing wells were the ants, then various kinds of flies, yellow jackets, and some sort of small bee—hundreds of them, so that the whole tree hummed as though a swarm had settled there. The sapsuckers consumed many of the insects thus attracted, especially the ants, which constitute more than one third their diet. Next came the ruby-throated hummingbirds, which nest high in one of the gray birches nearby. When I discovered them they were pushing their long, slender bills deep into the oval or roughly rectangular holes made by the sapsuckers and drinking greedily, poised on whirring, shimmering wings.

Suddenly my attention was attracted to a small, grayish-green bird fanning its wings as it tugged away at a strip of the thin white bark the sapsuckers had partly stripped off. It was a red-eyed vireo apparently gathering materials for a new nest, or, perhaps, due to a recent storm, patching up the old one for a second brood. Soon the butterflies also found the feast, particularly the mourning cloak and the red admiral.

But the sapsuckers stole the show, "noisy rollicking fellows" that they are in the spring of the year, according to C. Hart Merriam, while feeding on sap probably fermented by the heat of the sun, for in the fall they appear "quiet and reserved." The young, having been fed on insects and grubs in the nest, actually have to be *taught* to drill for sap and eat the cambium. The bird's tongue is brushlike, to help sweep in the sap, and completely lacks the sharp points of most other woodpecker tongues. It is also incapable of any great extension in length; so sapsuckers cannot obtain wood-boring insects. However, like cousin red-headed woodpecker, they often perch flycatcher fashion, waiting to capture insects in mid-air. The flight of these birds is fascinating to watch. W. E. Clyde Todd describes it in *Birds of Western Pennsylvania* as a "peculiar floating motion suggestive of the aerial maneuvers of a flying squirrel."

No less interesting is the great variety of their calls and the outlandish noises they make when several individuals are together. Most prominent is a seemingly endless catbirdlike mewing. I frequently heard a muted cry of *kee-a*, like a distant sharp-shinned hawk, and strident calls of *jay, jay*, confusingly like the blue jay's.



The first drills in the tree, which was twenty-three inches in circumference, were three and one-half feet from the ground.

The photograph below shows the variegated plumage of the bird.

This perching sapsucker bears a strange resemblance to a hummingbird. These birds seemed to do much more perching than other woodpeckers around the place.

This photograph shows well the yoke toes of the sapsucker. Its strong feet are necessary to make possible its constant hammering.

There were flicker-like calls, too, especially a soft *weet-a, weet-a*, usually given on the wing. The loudest of all the noises these clamorous birds make is produced by drumming on hollow branches or trunks of trees, or even on tin roofs. This is the love song during the mating season, and probably a signal at other times. To make this sound the sapsucker must first brace himself by the stiff "W" of his tail-feathers and the yoke-toes of his strong feet before stretching as far backward as he can. He then lets go with all the force of the powerful contracted muscle, so fast that his head becomes almost invisible. Consequently his skull must be extremely hard and thick to withstand the constant hammering.

The sapsucker's scientific name is *Sphyrapicus varius varius*—*Sphyra* is Greek for mallet; *picus* Latin for any sort of woodpecker. *Varius* can mean variegated or varying, either of which could apply to the sapsucker plumage, for its variations are many, not only in the immature birds but also in some adults. Not all females, for instance, exhibit the scarlet head patch—which the young do not acquire for a year; it may be smaller in size or entirely lacking, replaced by black, or streaked with white.

Although most woodpeckers are permanent residents of an area, the yellow-bellied sapsucker and its western variant, the red-naped sapsucker, *Sphyrapicus varius nuchalis*, are the most migratory of all their kind, although of course the flicker migrates also. They winter in the Gulf States, Mexico, Panama, and the West Indies, although some individuals remain in the warmer parts of the breeding range, especially the red-naped sapsucker in California.

The sapsucker is certainly the vegetarian among the woodpeckers, for 51 percent of its food is vegetable. I have never seen a sapsucker touch the suet always in holders on the trees nearest to the house. But they seemed to watch with puzzled interest when downies and hairies were at the suet holders.

Dietwise, the case against the sapsuckers may look rather bad. They do feed on the life blood of a tree and eat the cambium layer, which not only conducts the sap but gives rise to all the new tissues necessary to the growth of the tree. And their drills sometimes girdle the tree, although this has not happened so far to my birch. But they confine their drilling to one or two trees, to which they return season after season. Even though the trees may eventually die, the sapsuckers consume a great quantity of insects, both while the young are in the nest and later while feeding at their drills on trees.

Although my European birch is serving a completely different purpose than I had in mind when I planted it fifteen years ago, it is my "sapsucker tree." I only hope it survives many more seasons to bring these unusual birds back to me year after year.

In the preceding article Mrs. Burkhart touches briefly on the dietary habits of the yellow-bellied sapsucker. Last March, in his eightieth educational insert, entitled "Feathered Tree Cleaners," E. Laurence Palmer wrote of this bird: "May be definitely injurious to trees, particularly orchard and shade trees." This moved Mrs. Lawrence, Canadian ornithologist, to rally to the side of the sapsucker in the following discussion, not only of the economic question but of man's relationship to creatures that may affect his economy.

Is the Sapsucker Destructive?

By LOUISE de KIRILINE LAWRENCE

It is probably impossible to find any form of life that, in its normal development, is not beneficial to the specific niche and environment in which it is created to exist. Many teachings and beliefs to the contrary, the inherent goodness of all things is sooner or later borne in upon the thoughtful and objective naturalist. And this conviction speedily develops into one of his most valuable tools in his research into the problems of balance and interrelationships among the species.

To judge fairly the intrinsic value of its economic status with regard to its environment in a species like the yellow-bellied sapsucker requires, first of all, a disassociation from man's economy. For man's economy is never universally beneficial but an altogether egocentric proposition that produces a biased viewpoint.

Secondly, there is a need of thoroughly understanding the character, activities, and requirements of the species in question. Without this it is almost impossible to ascertain the subtle proportion between its negative and positive assets.

The best investigation hitherto accomplished into the economic standing of the sapsucker was one by W. L. McAtee and published in 1911 (Woodpeckers in relation to trees and wood products, U. S. Dept. Agric. Biol. Surv. Bull. 39). Its results are not to the advantage of the sapsucker and the study in its entirety is based exclusively on the bird's economic value to man. Nevertheless, it affords a good and instructive foundation for this discussion.

McAtee goes into great detail about how the sapsucker sucks sap, about the amount of cambium and bast consumed, averaging according to him 16.71 percent of the sapsucker's diet. He points out that cambium is highly perishable and that therefore the actual amount eaten is not easily measurable.

Nor can the sap be measured. A. C. Bent in his life history of the yellow-bellied sapsucker cites an experiment by Frank Bolles in which he raised three young sapsuckers from the time they were nearly ready to leave the nest to three and a half months of age. Each of these birds consumed an average of eight teaspoonfuls of diluted maple syrup in the twenty-four hours. It is significant that all three died from degeneration of the liver due to too much sugar. This suggests an effective physiological control directing the amount of sapsucking in which the birds may indulge.

McAtee's information on the effect of the sapsucker's borings on trees and wood products is the result of a carefully carried out study that covers many particulars. He found that the sapsucker attacks about 280 species of trees and vines. He points out that in sucking the sap the sapsucker attacks the tree in its vital part—that through which the life juice of the tree passes. Depending on how far the injury extends, the tree may survive the attack, but with its vitality lowered for a few years, or it dies. Moreover, the damage goes farther than to injuring and killing trees. In those cut down for lumber, earlier sapsucker attacks may have caused ineradicable blemishes. He mentions distortion of grain, knotty growths, staining, among others. In all fairness, he also suggests that the work of the sapsucker may sometimes have ornamental value in that it creates, for example, bird's-eyes and curly grain in the wood.

Because he found no evidence of any counteracting virtues in the sapsucker, such as extensive preying upon injurious insects, McAtee concluded that there was every reason for considering this bird harmful to man's interests.

When the sapsucker arrives in these parts of central Ontario, which lie in the ecotone between the vast coniferous forests in the north and the deciduous woodlands in the south, the sap is running high in all trees. It is surprising to note how little sapsucking the bird does at this time. New borings are uncommon; in fact, the observer must search far and long through the sapsucker ranges to find any. The sapsucker is most often found feeding on the pines and balsam firs that are already dying from the attacks of wood-boring insects and whose trunks are therefore running with exuding sap and resin. Ants, flies, and other insects, fill the remainder of his daily spring-time menus.

In the period between arrival, during excavation and incubation, until the young hatch, sapsucking continues to be restricted. There is a time when a great deal of feeding goes on near or on the ground. Places where the large carpenter ants are to be found are especially favored. Again and again the sapsucker returns, pursues and picks off these insects. Dead trees with loosened bark, stumps, and logs, are frequented for whatever palatable food the sapsuckers may find thereupon to satisfy their appetites.

When the young hatch they are first fed small insects, predominantly ants. Rapidly the rate of feeding increases from three to four to seven or eight times an hour. At four days of age one nestful of three young were fed 127 times during their parents' waking hours. Each of these feedings consisted of *several* insects, as many as the birds could cram into their mouths, and protruding on all sides of the bill. Most of these were moths and beetles, which were crushed to a pulp before being fed to the nestlings. Ants were fed less often than at first, and larvae were not distinguished among the food items.

During the 26 to 27 days of nest life, the feeding rate may reach a peak of 15 to 17 times an hour. At two nests, an average feeding rate of nine times an hour was obtained during 73 hours of watching. The food consisted mainly of moths, sometimes white, mostly brown in color, each species taken successively during their time of swarming. The forest in which this study was undertaken was heavily infested with tent caterpillars that season, and it is probable that many of the brown moths taken in July were of this species, the mothers of millions of eggs never to be laid. Hard-bodied beetles were next on the list. No feedings of sap were noted being carried to the young. The parents themselves were only rarely seen sucking sap at this time and they left scant evidence of sapsucking throughout their territories.

After emergence the fledglings are fed by the parents for another two weeks, during which time they gain their independence.

The sapsucker's neglect to take larvae, especially of the wood-boring kinds, has been held against it. But is not the taking of moths a good substitute for preying upon larvae in the general elimination process of injurious insects? The destruction of the (*continued on page 500*)

MOMENT MUTATION

That I should stand
Tiptoe to the poised ecstasies
Of full-throated
Bird,

Aware of every far-flung note,
Holds me breathless.
For the liquid beauty
I have no word.

Elizabeth Phillips Jones

Monuments to Pests

By MARGARET WHITTEMORE

Illustrated by the author

The grasshopper weathervane atop Boston's Faneuil Hall has a long and interesting history.

GRASSHOPPERS and boll weevils have been honored in poetry and sculpture by those who recognized their virtues, and forgave their faults. Hoppers had an understanding friend in Vachel Lindsay who wrote:

"I want live things in their pride to remain.
I will not kill one grasshopper vain;
Though he eats a hole in my shirt like a door,
I let him out, give him one chance more.
Perhaps, while he gnaws my hat in his whim,
Grasshopper lyrics occur to him."

Although Salt Lake City has a monument to the sea gulls, which at a critical time in Utah's history saved the crops from destruction by grasshoppers, certain members of the grasshopper family have themselves been lauded to the skies. The likeness of one famous individual, wrought in gilded bronze, glitters on top of the London Royal Exchange. The little drama in which this insect played the leading role had its setting in an English hayfield, where an infant boy had been abandoned. The grasshopper made its way into the baby's ear and provoked such loud and continuous wailing that he was eventually found and rescued.

When this boy, Thomas Gresham, grew to manhood, he became the royal financial agent, and was knighted by Queen Elizabeth in 1559. Later, in devoting a portion of his wealth to the erection of the Royal Exchange, Sir Thomas remembered his debt to the lowly grasshopper that unwittingly saved his life, and placed its gilded likeness atop the bell-tower.

Some people think the grasshopper weathervane above the cupola of Faneuil Hall in Boston is a copy of the one in London. Others suggest that the design may have been part of the Faneuil crest. The most colorful explanation, however, has to do with the weathervane's maker, the "cunning artificer," Deacon Shem Drowne.

When Drowne was a boy, so the story goes, he became discouraged by repeated failures in the New World and sought relief from his woes by walking in the country. One day he lay down in a field and soon fell asleep. He was wakened by a boy chasing a grasshopper and jumped up to join in the fun. Their frolic ended at the home of his new friend, who invited Shem in to supper. The parents, as it proved, were people of wealth. With a ripening of the friendship, they decided to adopt the lonely lad and enable him to develop his artistic talent. In time his ability as a coppersmith and carver of wooden figureheads won him renown.

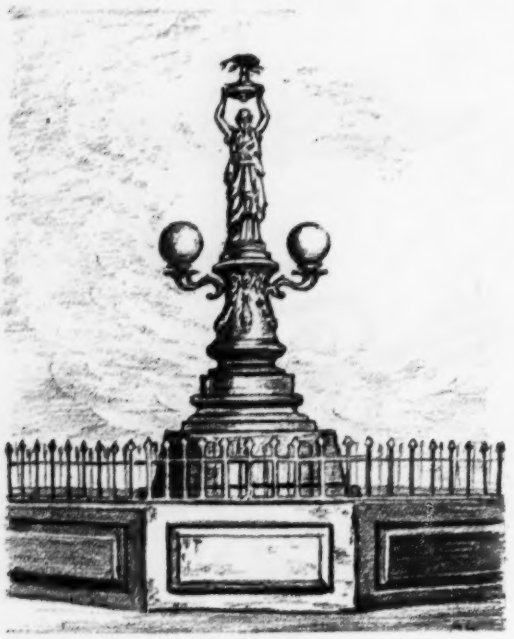
In "Drowne's Wooden Image," Nathaniel Hawthorne wrote: "No apothecary would have deemed himself in the way of obtaining custom without setting up a gilded mortar, if not a head of Galen or Hippocrates, from the skilful hand of Drowne. . .One of his productions, an Indian chief, gilded all over, stood during the better part of a century on the cupola of the Province House, bedazzling the eyes of those who looked upward, like an angel of the sun."

When choosing a design for Faneuil Hall's weathervane in 1742, what more natural than that the craftsman should fashion a copper grasshopper, commemorating its part in starting him on the road to success? So important a feature of Dock Square did this four-foot-long creature become that the place was often called "grasshopper market."

Three stranded American sailors in Glasgow once appealed to the consul, Samuel Cooper, for aid. Since they claimed Boston citizenship, Cooper tested their veracity by asking each one to describe the weathervane on Faneuil Hall. The first boy said it was a fish, the second a horse, but the third boy was the only one to prove his citizenship by asserting it was a grasshopper.

"Any man who claims to be a Bostonian," declared Cooper, "and can't tell what the Faneuil Hall weathervane is, must be an imposter."

This famous grasshopper has withstood the vicissitudes



The citizens of Enterprise, Alabama, erected a monument to the boll weevil because it changed their economy.

of more than two centuries, in spite of several narrow escapes. In the earthquake of 1755, it was thrown to the ground and lost one leg, which Shem Drowne's son replaced by vote of the selectmen. The fire of 1761 also caused damage to the copper insect with the green glass eyes. In his "Faneuil Hall and Faneuil Hall Market" Abram Brown gave a rather full account of the history of the grasshopper. He wrote:

"It was repaired by E. Vinal in 1852, when it was stuffed with coins and papers which came to light during the repairs of 1889, when Frank A. Worthly supplied new eyes, horns, and two new feet. When taken from its lofty position in 1898, preparatory to the general rebuilding, the vane presented a most weatherbeaten appearance; but by the skillful workmanship of E. B. Badger & Sons, coppersmiths of Pitts Street, it was repaired and placed upon its time-honored perch. It received in 1899 one new leg, a splice on its tongue, a patch on its body, and was re-gilded."

Further painting and repairs were made in 1923, 1946, and 1952. The sturdy creature remained aloft during the hurricanes of 1954, which brought down the steeple of Old North Church. On one occasion a workman found in its vest pocket a paper with written records of previous repairs, and in 1952 Thomas Stearns of Scituate, Massachusetts, obtained the most recent inside information on "Hoppy" when he discovered in the insect's stomach a copper receptacle labeled "food for the grasshopper" and containing Boston newspapers of 1889.

Collectors of antiques value certain sugar bowls and cream pitchers made by an Ohio glass company in early days and decorated with a grasshopper design. These were sold to help the people of Kansas who had been unwilling hosts to millions of ravenous grasshoppers in the summer of 1874. Souvenir spoons with grasshoppers etched in their silver bowls were also sold.

It is doubtful whether Kansans will ever find it in their hearts to erect a monument to this frequenter of meadows and fence rows as the people of Alabama have done in deference to the boll weevil. The town of Enterprise, Alabama, claims to have the only monument in the world glorifying a pest. It was unveiled on December 11, 1919, and bears the inscription: "In profound appreciation of the boll weevil and what it has done as the herald of prosperity."

This native of Mexico had entered the United States by way of Texas about 1892, extending its range until by 1922 most of the cotton-producing sections were infested. It almost made the Hit Parade with a little song, still popular in the South:

"O de boll weevil am a little black bug
Come from Mexico, dey say;
Come all de way to Texas,
Looking' for a place to stay.
Jus' a-lookin' for a home,
Jus' a-lookin' for a home.
"Now de fust time I see de boll weevil
He's a-sittin' on de square;
Nex' time I see de boll weevil,
Got all his family dere,
Jus' a-lookin' for a home,
Jus' a-lookin' for a home."

The year 1916 found the boll weevil family, and all the in-laws, comfortably settled in southeastern Alabama. The chief objection to their presence was the fact that

"De boll weevil got half de cotton,
De merchant got de res';
Didn't leave de farmer's wife
But one ol' cotton dress."

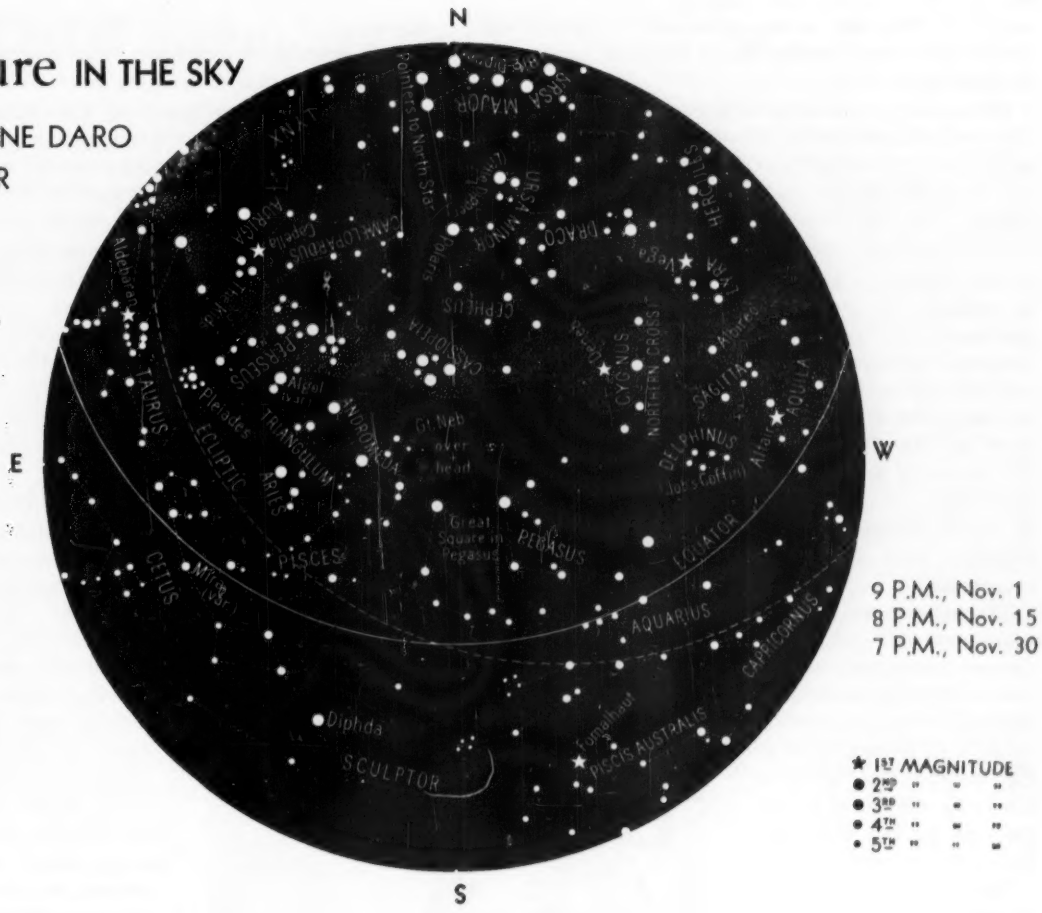
All efforts to evict the intruders failed. Farmers, facing bankruptcy and even starvation, finally began planting corn, potatoes, sugar cane, and hay, where nothing but cotton had been grown before. To their surprise and delight, these new crops yielded far greater financial returns than cotton had brought even in its best years. Peanuts, now the chief crop of Coffee County, proved particularly successful.

To show their gratitude to the little pest that had brought about this agricultural revolution, the citizens of Enterprise erected a monument in the form of a fountain with a fish pool at the base. A central column supports the figure of a woman in classical garb holding aloft a magnified boll weevil for all to see. Two years ago the insect mysteriously disappeared from the monument. The whole town celebrated its restoration with a parade and barbecue lunch on what was known as "Boll Weevil Day," when the original bronze insect was replaced by an even larger one, now securely fixed.

So we see that even grasshoppers and boll weevils can win Oscars for outstanding achievement and have their sculptured portraits placed on pedestals.

Nature IN THE SKY

By SIMONE DARO GOSSNER



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

Radio Astronomy

WITHOUT a doubt, the most significant development of astronomical research in the past few years has been the application of radio and radar techniques to the observation of celestial bodies.

We know that the sun and the stars are visible to us because they are incandescent masses of very hot matter. But we also know that their radiation extends beyond the limits of the visible waves, in the infrared and in the ultraviolet. It has been shown that the wave-length of the emitted waves depends on the temperature of the source, and that, under the proper conditions, matter will emit waves in the radio-frequency range, at centimeter and meter wave-lengths.

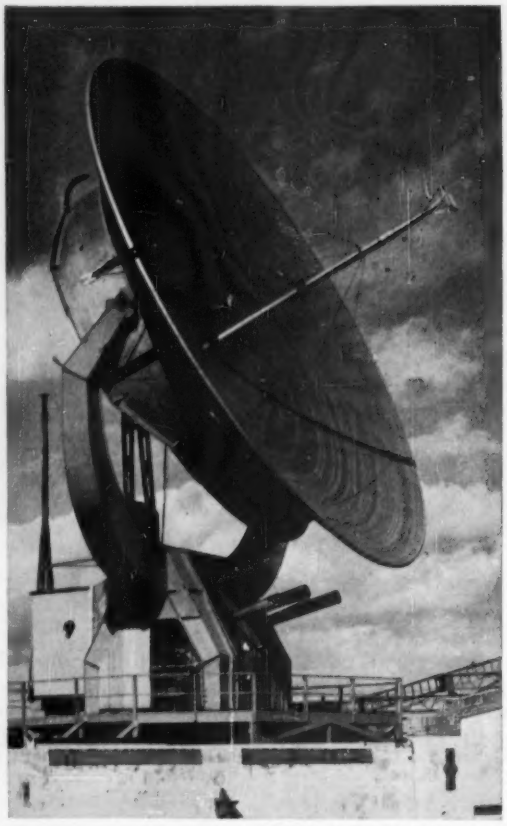
These cosmic radio waves are weak, and the technical difficulties involved in observing them were a challenge to the radio engineers many years before they were of real interest to astronomers as a tool in their studies.

In 1931, Karl G. Jansky of the Bell Telephone Laboratories, while working on a frequency of 20 Megacycles per second, found a relatively strong source of extra-terrestrial *noise*. He observed that the radiation was strongest when his aerial receiver was directed toward the center of the galaxy, but could be detected all along the galactic equator. The date of this pioneering discovery is usually considered as marking the birth of the new science of radio astronomy.

Progress was slow at first, principally because of the expense involved in building antennas of sufficient size. During World War II, however, military requirements brought about tremendous technological improvements in radar and in studies of radio propagation. At the conclusion of the war some surplus radar equipment was converted to peacetime use, and was made into some of the most powerful radio telescopes in this country. The

argest of these now in use in the United States is the 50-foot paraboloid of the Naval Research Laboratory in Washington, D.C.

Obviously, one cannot see or photograph a radio wave. The parabolic antenna is the counterpart of the mirror in an optical telescope, and its purpose is to focus the waves on the rod seen projecting from the center of the "dish." The rod converts these waves into an electric current, which is amplified in the receiver. The latter is equipped to provide a graphic record of the signal. Actually, the antenna does not have to be solid, like the one pictured here; wire mesh will do as well. For that matter, it need not be a paraboloid, either. Aerials in various shapes and combinations have been used successfully.



OFFICIAL U. S. NAVY PHOTOGRAPH

Fifty-foot radio telescope at the Naval Research Laboratory, Washington, D.C.

The methods used in radio astronomy fall into two distinct categories. First, there is the echo technique, which uses the principles of radar, and, second, there is the method that involves observing the radio waves emitted by the celestial bodies themselves.

The echo technique may be explained by drawing a comparison from familiar experience. Let us imagine that we find ourselves at night in an open field, and that we are looking for a barn with the help of a flashlight. As we aim the light beam in various directions, we do not see much because there is nothing around us on which the light may shine. But as soon as the flashlight is directed toward the barn, we see that there is something there because the ray of light has hit the wall and is being reflected toward us. This is precisely what happens in the radar, or echo, method. A radio signal, comparable to the flashlight beam except that its frequency is much lower, is aimed in various directions until it is reflected by a body in space. This body could be an airplane, or a meteor, or even the moon.

The second method may be illustrated by a similar comparison. When we were in the field, we could have found the barn directly if there had been a light burning in a window. In the same fashion, we can observe a body from outer space by means of radio equipment, if this body happens to emit waves at radio frequencies.

The echo method has been used successfully on meteors and on the moon. Technical difficulties still restrict it rather severely to relatively near objects. Another inherent limitation to reaching more distant objects is the time lapse between launching of the signal and return of the echo. Radio waves travel with the speed of light, and even if we applied the echo method to the nearest star, which is four light-years away, we would thus have to wait eight years for the signal to return.

Theoretically, the echo method is capable of yielding the most accurate determination of the moon's distance, but the measurements have not yet been made. In the case of meteors, the results have been of major importance. Radio observations can be made equally well in daylight, and for that reason many daytime meteor showers have been discovered. In addition to this, the study of meteor echoes provides us with valuable information concerning atmospheric conditions at heights where meteors are seen.

The second method is by far the more fruitful of the two. Direct radio observations have been made of the moon, Jupiter, the sun, the Milky Way, and even some external galaxies.

Radio waves from the sun were observed for the first time in 1942. They originate primarily in the solar corona, and, through their study, information is obtained about the temperatures and densities of matter that prevail in the sun's atmosphere.

The early observations of radio waves from the Milky Way were concerned with the study of the continuous emission over a wide range of frequencies. It was found that the intensity of the waves increases markedly toward the center of the Galaxy. At the same time, secondary peaks were observed in the direction of Taurus, Cygnus, and Cassiopeia. In some instances, it was possible to identify the observed radiation with some known optical sources. The Taurus source, for example, has been identified with the Crab Nebula, whereas the radiation from Cygnus is reaching us from two remote galaxies that collided millions of years ago.

In 1944, the Dutch astrophysicist, H. C. van de Hulst, predicted from theoretical considerations that the neutral atoms of interstellar (*continued on page 496*)

Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

Halloween in School

MOST OF THE MAGAZINES designed to give direct help to the classroom teacher are rich in detailed suggestions relative to school programs for Halloween. We hope that the insert in this issue of *Nature Magazine* will give a slightly different twist to the observance—a twist that will be recognized as educationally sound. We hope that teachers will be able to teach not only the assumed facts about bats, but the truth as well. Some may favor going all out at Halloween-time to build up an understanding of the superstitions about bats, but it would seem that any teacher should recognize an obligation to set the record straight by a follow-up and the truth about these useful animals.

We venture the guess that the greatest barrier to be overcome in attaining the result suggested above will be that of overcoming, in the teacher, the prejudices that may have been established by many years of uncorrected antipathy and many sources of prejudice and misinformation. This will call for some rather violent and possibly unpopular readjustments by the teacher, but this does not necessarily mean that these readjustments should not be made and that, once made, the future will not be improved for both bats and teachers. The earlier inserts published in *Nature Magazine*, the author's *Fieldbook of Natural History*, or any good natural history published in the last decade should provide good basic information.

Educationally which is the more valuable, to think of bats as foul creatures that seek to get in your hair and carry bedbugs, or creatures equipped by Nature with something like radar? Imagine a creature so responsible to its environment that it can dart in darkness among the twigs of trees without touching them! Think of an animal that can follow a falling pebble the size of a pea through the air, using only as a guide the echo of sounds that we ourselves cannot hear! Think of a creature that mates in the fall but delays the fertilization resulting from that mating until the following spring. Think of a mother bat that can fly through the air seeking food while her young hangs from her underside! Think of animals that are among the few mammals that truly hibernate, or of an animal the size of a bat that can fly far out at sea! Think of a few of these things about bats and you might well be ashamed of limiting your pupils' appreciation of bats to what you find in the usual teachers' educational journal.

Changing beliefs

Of course, what goes for bats goes to some extent, also, for many of the other creatures featured at Halloween-time. It might be interesting, but also dangerous, to explore the background of the beliefs of your pupils about the realities of ghosts and the like. Yet if these bits of folklore are left entirely untouched they may continue to persist and be handed down to future generations. The handling of such situations should call for superior tact and good judgment, and success or failure may well depend on the approach made and the ability of the teacher to let the pupil reach his own conclusion from the facts presented. It may well be that the only responsibility of the teacher is to present the facts, making no attempt to show how they differ from local prejudices and seeking no expressed conclusion on the part of the pupils. It is more important that the students be equipped to come to a rational conclusion than that they be forced to come to any conclusion.

When I first began teaching in Iowa I had a class in general Nature study. One day I brought a beautiful little snake into class to use as a demonstration. One attractive farm girl among my students insisted that what she saw was not true because her grandmother had told her otherwise. In fact, she insisted that her grandmother had seen snakes do things that I am sure they never did. Even my own sister once insisted that she had seen a snake do something that I know they never did. Now what can you do in a case like this?

My sister and I have made a reasonable adjustment on the snake issue, but I am sure that to this day that "corn" fed Iowa girl is probably telling her grandchildren what her grandmother had told her, and doing it with equal conviction.

It seems to me that Halloween might be the best time in the year for teachers to tackle this blind prejudice business, and to give superstitions a run for their money. I rather suspect, however, that with all this advice from me that Iowa girl still thinks that young Eastern teacher did not know what he was talking about. I am positive that the janitor in my building there was sure that he was right in insisting that if ducks walked across a newly planted wheat field the wheat would come up as quack grass. Eventually they held a prayer meeting to save my soul in that town because I had suggested that there might be something to evolution. They even held it in the home of the village bootlegger, with whom I had some differences of opinion.

The truth appreciated

What gave me great satisfaction a few years ago, though, was to meet some of these people and to learn that, while they did not admit it at the time, they came to realize that maybe I was not so far wrong as they had once assumed. Further they seemed to like me for the way I had handled an unpleasant subject that perhaps might have created a lasting enmity, a persistent prejudice and a real failure to understand the environment that gave them their living. To me the greatest satisfactions from teaching do not come from the reactions of gushers who come up after a public lecture, spread the praise on thick and then ask a favor. Pleasure comes from those whom you meet decades later and who spontaneously express appreciation of guidance that was given by one whose chief ambition was to teach the truth.

Halloween offers a challenge and an opportunity to any teacher, but this is particularly true of the science teacher who uses against falsehood the objective materials with which he works. As time goes on, and as increasing populations magnify the

(continued on page 496)

THE Nature CAMERA

By EDNA HOFFMAN EVANS

Art and Camera

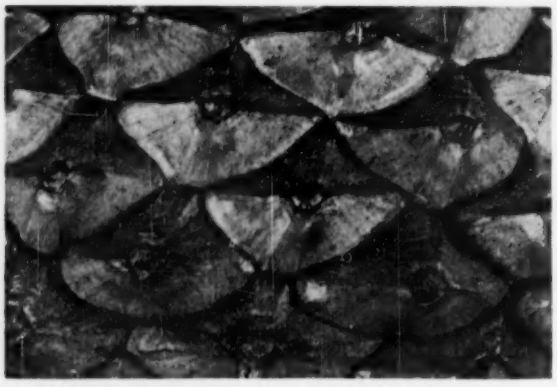
EVERY SO OFTEN I "meet-up" with an artist, usually a painter, and I am always interested in said artist's reaction to photography. I have found a few artists who looked down their noses at the cameraman and maintained snootily that there was no such thing as "art" in photography. A few others said that photographers can produce nothing but "calendar art"—that is, pictures that are "pretty" enough to appeal to the ordinary run-of-the-mill taste. The implication here is that "pretty" pictures are not "art." Naturally, I disagree heartily with both such reactions.

As a rule, though, artists are interesting people to talk "pictures" with. They "see" things in much the same manner as a photographer sees them. They think in terms of light and shadow, of color, of form, of depth, and of composition I find their reactions and interpretations exceedingly informative.

Not long ago I met and visited with an artist who works in two different fields—still life and landscapes. His still life paintings were beautifully done. They had fine detail, depth, and rich color; they were, in fact, "alive." His landscape technique was quite different. While the drawing and details were good, they were painted in a "high key." As a result, his pictures were pale where they should have been vivid, washed-out where they should have been intense, or so they seemed to me.

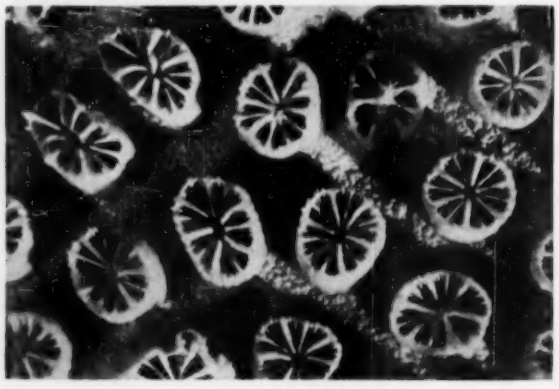
His reason for painting landscapes in that manner was particularly interesting to me as a photographer. The sunlight, he said, was so intense that it did to a scene the same thing that over-exposure does to a color transparency. So he painted canvases that were, in a sense, over-exposed. The intense greens of Nature (in the region where he painted) became pale yellow-greens;

"Family Group" by Grant Haist.

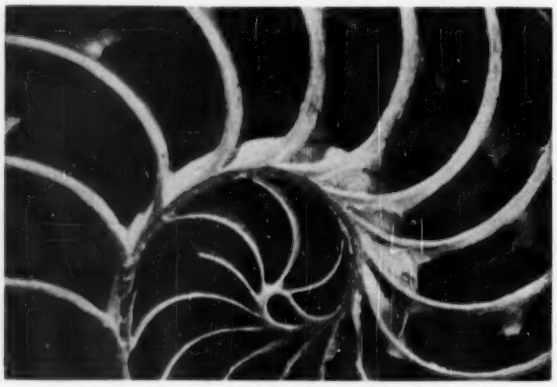


"Pine Cone Scales" by William Harlow.

"Flamingo City" by K. Mayer.



"Reef Coral" by Don Nibbelink.



"Pearly Nautilus" by Don Nibbelink.

bright reds took on an orange hue; deep blue skies became pale and grayish. I kept wishing, as I looked at his landscape paintings, that he would "stop his lens down" so to speak, and produce a picture that was exposed properly. But that was his technique and, to borrow a line from Kipling, I think that every artist (in whatever medium he chooses) has the right to:

"Draw the Thing as he sees It for the God of Things as They Are!"

I do not know who works harder, a painter or a photographer. Of course, at first thought, anyone would say that a painter spends long hours before his canvas, palette in hand and brushes busy, while the photographer merely clicks a button and the picture is made. Ah, but is it? There is much yet to be done—time spent in the dark developing the film. Then there is more time spent in the semi-dark printing the picture, composing it under the enlarger, using the proper paper, and so on.

But not all the photographer's work comes after the "click" of the shutter. He spends time, too, searching for the scene he wants, composing it, waiting for just the right light and shadows. Sometimes he never can get exactly what he wants and so must do the best he can with what is available.

The artist's advantage

With composition, as well as with lighting, the paintbrush artist has the advantage over the camera artist. The painter can compose his scene as he wants it; he can move a tree or a house or a lake or a mountain. He can paint a quaint old street without light wires and telephone poles. He can omit the automobiles parked in front of a picturesque 18th century building. Never having tried my hand at painting, I do not know what frustrations can plague the artist, but I do know how many times my artistic desires have been foiled by unsightly light wires, poles, fire plugs, autos, trash containers, signs, and dozens of other distracting details that I did not want included in my pictures. True, I could master the technique of the air brush, and perhaps other darkroom devices, that would erase unwanted details from my pictures, but I probably never will.

I suppose I am a "realist," tinged with a large measure of "romanticism," since I do not like unpleasant details in my pictures. Another school of artists—the extreme modernists—do strange things with their pictures. Now modern art, I know, is a highly controversial subject, and one in which the discreet layman should not meddle. For my part, I am ready to admit that I do not understand modern art, but on the other hand I do not entirely dislike it. Some examples, to be sure, I find as horrifying and disturbing as some of Albrecht Durer's 16th century woodcuts and engravings. When I was studying art history some of the creatures from his "Apocalypse" series used to give me nightmares. On the other hand, some samples of modern non-objective art seem very restful and satisfying. I could "live" with them quite happily.

"Abstraction in Ice" by Otto Litzel.

But what does modern art have to do with photography? I think the photographer can go modern—even non-objective—if he chooses his subjects accordingly. Perhaps the photographer cannot go as wild as the non-objective artist, but he can show patterns, designs, and repeating motifs that appear almost as fantastic as anything the non-objective artist can imagine. And, strangely enough, the photographer can take many of those "modern" themes directly from Nature.

Modern camera art

The pictures that illustrate this section are good examples of what I mean by "modern art" in photography. They are selected from among the many prints and transparencies submitted to the Chicago Nature Photography Exhibition, of which H. J. Johnson, 2134 Concord, Chicago 47, Ill., served as chairman.

The ordinary snapshooter or candid

(*continued on page 497*)

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School

(*continued from page 493*)

competition for survival, the person relatively free from the shackles of persistent superstition has the greater opportunity to help himself and others. We know that there are no ghosts, but belief in them, assumed or otherwise, is not likely ordinarily to be of life or death importance. Farmers, from one end of the country to the other, know the techniques to prevent soil loss through erosion, but still tons of valuable top soil are lost each year through practices that we know are wasteful. The soil-loss story is not a ghost story, although it has sometimes been used to try to frighten some folks into correcting their ways.

Skies

(*continued from page 492*)

hydrogen should emit radio waves at a wavelength of 21 cm, or, which is equivalent, a frequency of 1420 Megacycles per second.

The 21 cm radiation was observed for the first time by Ewen and Purcell of Harvard in March, 1951. The discovery was confirmed a few weeks later by Dutch astronomers, who observed it independently.

Because interstellar hydrogen is widely distributed throughout the Milky Way, the 21 cm radiation has become one of the most powerful tools of radio astronomy. The propagation of radio waves through space is not blocked off by interstellar dust, as is the case for light rays. For that reason it is possible to penetrate through the dust clouds and observe the presence of hydrogen in regions of the Galaxy from which starlight cannot reach us. Thus we see that the information obtained in this fashion complements the optical data.

Vast masses of hydrogen have been shown to occur mainly along spiral arms. In the scant four years that have elapsed since it was first observed, the 21 cm radiation has revealed more about the spiral structure of the Milky Way than all the optical observations accumulated since Galileo invented the telescope.

In the month of November, the New Moon will occur on November 14, and the Moon will be full on November 29. A partial lunar eclipse, not visible in the United States, will take place on November 29.

Of the planets, only Mercury, Mars and Jupiter will be favorable for observation.

In the early part of November, Mercury will be found low in the southeast near Spica, in the morning sky. It will rise about an hour before the sun on November 15, and at about sunrise on November 30.

Mars, in Virgo, will rise about two and one-half hours before the sun on November 15.

Jupiter, in Leo, will rise shortly before midnight on November 15, and will be overhead at dawn. It will appear close to Regulus, with which it will make a striking pair.

The Taurid meteors will be visible November 1 through 10, with a rate of six per hour. The Bielids on November 14 and the Leonids on November 16 are not expected to be seen this year.

Deserts

(*continued from page 484*)

unable to find evidence that any real attempt was made to educate officers in charge of extensive desert maneuvers as to the desirability of conserving wildlife in the territory under their jurisdiction. Both Army generals and GI Joe seem to share the far too common attitude that all desert lands are expendable and that all desert wildlife is poisonous, and, therefore, worthless.

Suggestions that the armed forces consult and cooperate with authorities on desert wildlife and desert lands in working out a program for their protection far too often are brushed aside. Protests against misuse have been either treated with scant courtesy or completely ignored. As a result the rape of the southwestern deserts continues at an ever-accelerated pace.

To remedy all this a long-range study, an over-all policy, and a well-considered program are necessary. These must be worked out and approved by top echelon officers in Washington in collaboration with accepted authorities on the conservation of the desert. The program must be enforced with vigor upon every branch of the armed services in every installation in the Southwest, whether it be permanent or temporary.

Such a study should include, too, consideration of just how truly necessary is the demand for more and more territory. Many persons familiar with the desert certainly feel that there is dismaying duplication in the use—or misuse—of land now under armed services control. Much land now closed to public use could be relinquished if some sort of agreement could be worked out for unilateral use of artillery and other ranges by the various divisions of the armed services.

The proper training of armed services personnel and the proper testing of the instruments of war are, without question, essential. But why the desert lands? Might it not be possible to use California's offshore islands, which for many years have been under armed services control? There the sky would be the limit as far as firing ranges are concerned. If these islands are inadequate, what about artificial islands? Their construction might solve the problem of what to do with the vessels now in our mothball fleet.

Not long ago I ventured into a desert wash located near, but not in, a signed abandoned army training camp. My objective was a particularly interesting smoke tree that I wished to photograph. I had some difficulty getting the tripod evenly and firmly set up. The day was hot, and I got a bit harassed and cranky as the jointed legs became more and more unmanageable. I kicked a few loose rocks out of the way, and there, directly under my tripod, was the ugly, egg-shaped nose of a mammoth unexploded shell. Despite the heat I felt a cold chill go down my spine. Needless to add, the smoke tree remained unshot.

Surely the high brass of the Pentagon can come to see the wisdom of joining in the effort to determine that the very qualities that now lure us to the desert shall not vanish from the southwestern scene. Photographer, rockhound, botanist, biologist, hiker, just plain meditator—humans all—should, with lesser wildlife, feel free from the restraints of "Danger—Peligro" in most of our southwestern deserts.

The deserts, like the high alpine meadows of our western mountains, heal very slowly from man-made wounds. Yet their power to bring solace to the heart of man is great. That so many thousands of Americans go to them to find the stimulus to contemplation that is afforded by their solitudes, by their wide horizons, and by their ingenious and courageous animals and plants, is proof sufficient that they are not expendable wastelands which we can afford to ruthlessly destroy.

Camera

(*continued from page 495*)

camera fan would not take pictures like this. But the camera artist, who sees beauty in abstract forms or in bits of things, does take such pictures whenever opportunity permits.

By way of contrast, notice the curved lines in the picture of the "Pearly Nautilus" taken by Don Nibbelink, and then compare it with the straight lines and sharp angles of "Abstraction in Ice" taken by Otto Litzel.

For repetition of pattern, compare "Reef Coral" by Don Nibbelink with that of the "Pine Cone Scales" by William Harlow. Both subjects are fairly common—the coral perhaps not so much so as the pine cone but neither rare nor hard to obtain in native surroundings. For more repetition of form, but this time irregular rather than in pattern form, notice "Flamingo City" by K. Mayer and the mushroom "Family Group" by Grant Haist. Both show interesting contrasts of texture within the individual picture.

Except for the mushrooms, all these pictures would be rather baffling without their titles. It would take considerable study to figure them out, as is also the case with most abstract paintings. Just what anyone can do with such pictures is a matter open to question. They do not belong in a snapshot album, and as framed pictures on the wall they would be out of place without the proper setting. Yet in taking them, I am sure the photographers fulfilled some sort of artistic drive within themselves. And so, just as there are art-for-art's-sake-artists with brush and canvas, so I think there are similarly inspired artists with the camera.

Photography and the law

And now, coming down from the rarefied atmosphere of art, let us look at photography from another angle. This time we are anchored firmly to fact, reality, and law.

Several years ago, some readers may remember, there appeared in this section the review of a weighty legal tome entitled *Photographic Evidence—Preparation and Presentation*, written by Charles C. Scott of the Kansas City, Missouri, bar and published by the Vernon Law Book Company of Kansas City. The book was first issued in 1942, with a supplementary section added in 1947. Now, in 1955, a new supplement has been added, giving much additional information, first on photographic equipment and second on court decisions involving the use of photography.

For those of us who think of photography as a hobby, as a form of art, or as a means of livelihood, it is interesting to learn how much legal procedures also depend on photography. As photographic equipment has been improved, and as the range of photography has increased, the use of pictures, slides, and films of all kinds in the courtroom has increased. Indeed, in some instances photography has done what would otherwise have been impossible in preserving information and presenting evidence.

Among the new cases reported in the 1955 supplement is a Texas suit in which photographs of the impressions left by a pencil were used to restore erased writing; in another instance, infrared photography was used to bring back a signature all but obliterated by bank endorsement stamps.

The new supplement devotes considerable space to photographic equipment, including cameras, lenses, films, and papers, listing by trade name those which are recommended and those which are not. "Who-done-it" and "cloak-and-dagger" fiction fans may be a bit disappointed to know that, concerning the "match box camera" developed for espionage purposes during the war, the supplement has this to say: "It is possible that cameras of this type may be found of some use in criminal investigation, but it does not seem probable that they will ever supersede the larger cameras." Dick Tracy please note.

Trees and Shrubs of the Upper Midwest

By Carl O. Rosendahl. Minneapolis. 1955. University of Minnesota Press. 411 pages. Illustrated. $6.00.

The area covered by this excellent book is rich in both number and variety of trees and shrubs. Here, then, is an excellent guide to the identification of these woody plants, both native and cultivated. In 1928 the author, with F. K. Butters, published *Trees and Shrubs of Minnesota*. This present volume retains much of the text matter of the earlier publication, with distribution data broadened to cover the wider geographical range of this new and fine book.

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Snakes

(*continued from page 459*)

operation may be completed in less than half a second.

Snake venom, a complex blend of proteids, helps in the capture of food, making it possible for the limbless, handless hunter quickly to paralyze small creatures which otherwise might be strong or quick enough to get away. A venomous snake employs its poison against big animals or human beings only rarely and reluctantly, in self-defense. The rattlesnake basking on a sunny rock ledge, the copperhead stretched at ease on the checkered forest path, wants nothing so much as to be let alone.

Deaths from snakebite in the United States total under 100 per year. Scientists agree that widespread knowledge of five simple rules, when poisonous snakebite does occur, would keep this figure still lower. The rules they prescribe are these:

First: Keep calm. Don't run, don't drink spirits. Most snake poison spreads relatively slowly but panic, excitement or alcohol will accelerate its action.

Second: If possible, apply a tourniquet above the bite. Since most snakebites are on legs or hands, this is usually feasible. Don't bind the tourniquet too tight. (You should be able to insert a finger under it.) Loosen it for a few seconds every ten minutes.

Third: With a sterilized knife or razor, make a cross-cut (X) one-quarter-inch deep over each fang mark. Lacking any antiseptic with which to sterilize, use a match flame. Then suck the wound to encourage bleeding and draw out as much venom as you can. (The venom will not hurt your mouth, unless you have open sores there. Snake venom must get directly into the bloodstream to be dangerous.)

Fourth: If swelling increases, move the tourniquet, keeping it above the wound.

Fifth: Get to a doctor as promptly as you can *without rushing*.

The life span of a snake may be many years. A water moccasin has lived to be 20, a boa constrictor 23. Even a little garter snake, contented in captivity, has reached 11.

A snake becomes sexually mature usually in its second or third year. Only a few naturalists have been privileged to see the ritual of courtship. Among common water snakes and garter snakes, the male fondles his chosen female by rubbing his chin gently upward along her back, in a series of gliding caresses. Blacksnakes and other racers engage in a courtship dance. Weaving, bobbing, rearing with heads almost touching and then whirling in a new arabesque of challenge and response, the two courting snakes are whipped into a flashing crescendo of excitement.

A few months later there comes into being a new generation of perhaps the most curious living creatures with which we share the adventure of life.

Apalachee

(*continued from page 463*)

Spring's chief attraction is the panorama seen below the crystal clear and sky-blue waters.

Through glass-bottom boats one looks down, in places 185 feet deep, into a fairyland of fishes, from tiny gay tropical varieties to enormous species. The fishes flit through a veritable garden of submarine plants, growing amid fantastic formations of rock and shell. In the jungle cruise down the river one sees the limpkin, or wailing bird, that rare, shy bird, also herons, anhingas or snake-birds, coots, ducks, ospreys with their huge nests high up on the moss-laden trees. The spider lily lies like snow on the waters, the ribbon or eel grass bears small, white, bridal-wreath-like flowers among myriad jungle plants.

But the greatest of all mysteries in this region is the famous "Wakulla Volcano," which is, or was, located in the Waeissa Swamp, about twenty miles east of the Spring.

It is not known when this phenomenon first gave forth its manifestations of visible fire and smoke, but numerous Indian legends indicate that it must have been seen as early as 1650, if not before. During the Civil War sailors saw it—from far out on the water—a tall, slender column of smoke sometimes shot with flames, now black like pitch-smoke, now gray like the smoke from burning leaves, and again like steam.

There are still old-timers in the villages of Chaires, Capitola, and Wacissa, southeast of Tallahassee, who claim to have seen the smoke at some time or other.

Many stories arose about this "volcano," and between 1870 and 1880 there were numerous attempts to reach it. Northern newspapers and magazines sent eager representatives to try and unravel the mystery, but although several tried to reach it while it was still burning, mud too thin to walk on or too thick to shove a boat through barred the way.

Finally, in 1886, at about the time of the Charleston earthquake, the smoke stopped. Many believe that the open fissures, through which visible flame and smoke penetrated, were closed by the sliding of underground rocks caused by the earthquake. Certainly it has never been witnessed since. In recent years drillers have found indications of petroleum near the village of Wakulla, and it is thought by some that the smoke may have come from an oil seepage, ignited by lightning.

There is still another theory. William Wyatt, writing in the Tallahassee Historical Society Annual for 1935, says that much of the Wacissa Swamp, home of the mysterious smoke and fire, consists of peat and muck lands that are the early stages of coal formation, all of which had their origin in some prehistoric forest that was covered by water. After explaining the existence of the limestone cavities and sinks of this region, he adds that in ages past, these sinks and depressions were filled in by decaying vegetation and debris, much of it being carried into the farthest parts of the caverns by the waters of the various inundations.

Then, at some later date, after the floods had subsided for the last time, something happened to set this vast underground storehouse of combustible material afire, and, as in the coal fields of Pennsylvania, the fire continued eating away at the vitals of the earth until it broke through the surface at some weak point. The underground fire continued to feed the visible smoke column for decades until, perhaps, once more as in the Charleston earthquake, Nature, tired of the old, caused a shifting of the earth which smothered the fire, or perhaps shifted it to a lower level.

It is quite possible that neither of these theories is correct, and that the nearest one will ever reach a solution to the mystery is by agreeing with the hero of Shakespeare's greatest tragedy that:

" 'There are more things in Heaven and Earth, Horatio,
Than are dreamed of in your philosophy'."

Forestry and Related Research in North America

Prepared by Frank H. Kaufert and William H. Cummings. Washington, D.C. 1955. Society of American Foresters. 280 pages. $5.00.

This book is the result of a study conducted by the Society of American Foresters under a grant from the Rockefeller Foundation. It deals not only with timber resource, its products and utilization, but includes those parts of wildlife, range, watershed and recreation resources and activities that have their basis in forest lands. The report here published surveys the progress of research during the past 25 years and recommends goals to be sought during the next quarter-century. There are three parts to the book, divided geographically and dealing with forestry and related research in the United States, Canada and Mexico.

Salamanders and Other Wonders

By Willy Ley. New York. 1955. The Viking Press. 293 pages. Illustrated by Olga Ley. $3.95.

Perhaps nobody else would think of starting a book with a discussion of the olm, a colorless cave salamander of Yugoslavia. But then, Willy Ley is a "romantic naturalist," as he has amply proved in his earlier *The Lungfish, the Dodo and the Unicorn* and *Dragons in Amber*. Happily for the reader, this author is able to spare time from his preoccupation with rockets and space travel, to assemble some fascinating and off-the-beaten-path natural history. In this book he can jump from olms, to abominable snowmen of northern India, to the man-eating tree of Madagascar, and it is fun to jump with him.

Geology of Southern California

Compiled and edited by Richard J. Jahns. San Francisco. 1955. California Division of Mines. 878 pages; 441 text figures; index map; 34 map sheets with texts and illustrations. $12.00 (3 percent tax for California residents.)

This is issued as Bulletin 170 in the Division of Mines series, but "bulletin" seems rather a misnomer for this valuable publication, which is really a book and comes in a sturdy cardboard box. The title is descriptive of the contents of this box, which, incidentally, weighs ten pounds.

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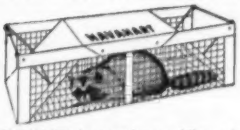

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Sapsuckers

(*continued from page 488*)

moths represents the annihilation of a larval survival percent, a part of the mass of larvae destined to live for the assurance of a multitudinous progeny. On the evidence of this investigation it would therefore appear rather likely that the yellow-bellied sapsucker's intake of insects, injurious or otherwise, has been considerably underrated in the past. When thereto is added the sapsucker's disinclination to suck sap at a time when the sap is running high and the trees register their maximal growth it seems that during the nesting season, at any rate, the verdict must be distinctly in favor of the sapsucker.

The pattern of the sapsucker's life changes after the young have reached independence. In the old birds—and in the young ones slightly later—the moult sets in and progresses at a rather rapid rate, with the regrowth of the plumage following more slowly. At the onset of this the whole family retires to a restricted "sapwell" area, or "orchard" as it has been called by some writers, usually not more than an acre in size. This area is most often the same which the pair used in previous seasons, and not seldom may newly established young pairs be found using the same one as a predecessor territory holder worked before them. Commonly this area is in dense stands of trees, primarily a choice of protective significance. From late July to the departure south in September and October, this is the place and the time when the main part of the sapsucking is done by adult and young birds alike while on the breeding grounds.

The average size of territory or range needed for each pair of yellow-bellied sapsuckers is about five acres. Thus, even if the ranges are honeycombed together, the sapsucker population cannot be dense. There is not more than one sapwell area in every sapsucker range of five acres; but, of course, two such areas in adjoining ranges may sometimes be situated not far from each other.

The examination of trees used by three pairs of sapsuckers and their families brought forth the following results. One *main* tree was used as chief source of sapsucking by each family. This was always a tree that had been ringed previously. The main tree was worked each season by the resident pair until it died, while the other trees in the surrounding sapwell area were comparatively little used. If it died during the sapsucking period, another was selected as a main tree. It is in all probability such trees that McAtee came upon when he described cases of extreme mutilation. Naturally, as the doomed tree dies, larger areas have to be laid bare to secure the slow-running sap in late summer and fall. Nevertheless, the economy of sucking sap predominantly from one main tree can hardly be refuted. Furthermore, only main trees of all the trees attacked on the sapsucker ranges were observed to be killed directly by sapsucking. And since a main tree often lasts from one season to another, it can safely be said that a pair of sapsuckers kill outright by sapsucking less than one tree in each six-month period they spend on the breeding grounds.

In this region the birds favored white birches for sapsucking during late summer and fall. Most of the trees chosen were young, those more than 30 years of age were seldom attacked. Of thirty trees only one was apparently well grown and uninjured before being ringed by the sapsuckers. The others selected were either stunted, or stood with dried tops in dense communities, or had been struck by lightning, or otherwise injured by man or previous ringing by the sapsuckers themselves. In other words, only one tree in thirty might have had any economic value as firewood or lumber before the sapsuckers touched it.

In this way, from a forestry viewpoint, the sapsuckers helped to eliminate trees that grew too densely for maximum development and others that were injured and took up space and light for younger growth. They did not "wastefully" attack new victims, but obviously much preferred to bore in trees they had used before.

In Europe artificial ringing of the trunk of a tree is known to produce increased seed crop and is practised by German gardeners. The Czecho-Slovakian ornithologist Turcek suggests (The Ringing of Trees by some European Woodpeckers, 1954, Ornis Fennica, 31:2), in connection with this effect of artificial girdling, that sapsucking woodpeckers by inextensive circling of the bark might well contribute to the maintenance of the tree crop by producing thus increased fruition. In five trees out of thirty evidence was found that the work of the yellow-bellied sapsucker might indeed have had the very same effect.

An increase in numbers beyond the allowable optimal in any species is always detrimental for its environment. And to this law the sapsuckers claim no exemption.

In this region the sharp-shinned, Cooper's, and the pigeon hawks act as one of the controls of small bird populations. It may perhaps be considered as a further ounce in the yellow-bellied sapsucker's favor, that he and his family compose a large part of the support of these important agents in Nature's self-controlling system.

For the fidelity to the laws laid down for his living which he embodies, for his beauty alone, surely this interesting and gallant bird deserves to be far better known and appreciated, and not merely to be grudgingly tolerated!

Frogs of Southeastern Brazil

By Doris M. Cochran. Washington, D.C. 1955. Smithsonian Institution. 423 pages. 34 plates. Superintendent of Documents, Washington 25, D.C. $2.00.

This distinguished contribution to literature about amphibians is made by the Associate Curator, Division of Reptiles and Amphibians, U.S. National Museum. And Dr. Cochran dedicates this book to "the memory of Dr. Adolpho Lutz (1855-1940), whose pioneering work in Brazilian biology and medicine has left an enduring mark on tropical research." Research into the herpetology of tropical America has been carried on by the staff of the Division of Reptiles and Amphibians for more than half a century. And Dr. Cochran spent five months in Brazil at the invitation of Dr. Lutz, with whom she visited many type locations and collected.

Three Tickets to Adventure

By Gerald M. Durrell. New York. 1955. The Viking Press. 203 pages. $3.75.

This is a third book by the author of *The Overloaded Ark* and *The Bafut Beagles*, and in the same vein of high adventure and humor. This book is concerned with British Guiana, where the author and a companion went to collect small-to-medium animals for British zoos. Here is entertaining reading, indeed.

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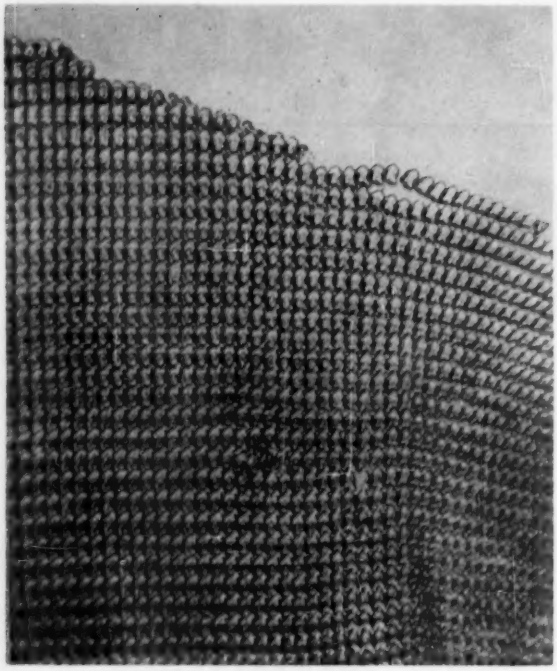
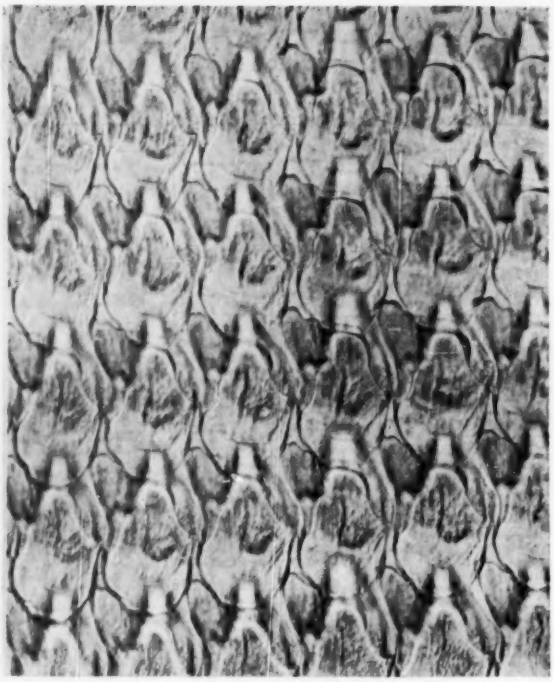


Radula of Helix pomatia, 70X.



Detail of radula, showing teeth, 500X.

Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON

(PHOTOMICROGRAPHS FROM SLIDES LOANED BY WARD'S NAT. SCI. ESTAB., INC.)

ANIMATED RASP

If you could look into a snail's mouth while he was eating you would see the working of an apparatus of great ingenuity, complexity, and interest, very different from anything with which we are familiar in the way of jaws or teeth. The microscopist can, in effect, do just that, obtaining and mounting this machinery with relative ease, thus making a slide of beauty, intricate detail, and value in classification.

The great tribe of Mollusks, second in numbers only to Arthropods, is divided into five Classes, represented by chitons, tusk shells, snails, clams, and squids. In these, save only the clams (Class Pelecypoda), the mouth opens into a *pharynx* provided in most cases with a jaw or jaws above and a radula below, by means of which the food, either plant or animal, is obtained and comminuted before passing through the esophagus to the stomach. The jaw to some extent and the radula to a high degree have for many years intrigued *malacologists*, those zoologists whose specialty is the Phylum Mollusca.

Situated in the roof of the *buccal cavity*, or mouth, just behind the upper lip, is the *jaw*, usually either a crescentic ridge of chitin, often reinforced by striations or ribs, or a pair of elaborately sculptured plates. Sometimes accessory pieces are present, but in carnivorous snails the jaw is completely lacking. In the Class Cephalopoda, containing nautiluses, squids, and octopuses, the jaws are called beaks, from their resemblance to those of parrots—superficially similar except that the lower jaw closes over the upper. In this group, far from being a simple cutting ridge, the jaws become a formidable weapon.

But it is with the structures in the floor of the mouth cavity that we shall be concerned here. There is a large infolding of this floor to make a sac-like cavity, the *radula sac* or *odontophore* (tooth bearer), behind the lower lip. Below the sac, the tissues make up a *tongue*, consisting of a *basement membrane* that becomes chitinized and which supports a number of calcareous *teeth*. Research by Meisenheimer has shown that epithelial cells in the roof of the sac increase by mitosis and push around the rear to the floor, where they eventually become *odontoblasts* or tooth-makers. A number of rows of these cells cooperate in secreting a single tooth. Then, reduced in size and being continually pushed forward along the floor of the sac, they become a part of the basement membrane, become chitinized, and support the tooth they have secreted. Toward the front of the floor, where the teeth come into use, they are worn out and eventually lost, continually replaced from behind. Thus there is a constant growth around the sac from roof to floor—rearward in the roof, forward in the floor—ending as worn out and discarded teeth. The basement membrane and the teeth it bears constitute the *radula* (L., scraper) or *lingual ribbon*, the latter term being especially appropriate in those species in which it is very long and narrow. Beneath the radula lie cartilaginous supporting rods and to these are attached

muscles that can pull the radula forward or back. This whole apparatus comprises the *buccal mass*, the term preferred to tongue by most writers. Primarily, the jaw closes against the anterior teeth of the radula to effect a bite; secondarily, the radular teeth rasp against the food to shred and reduce it. The teeth in general are sharp and recurved and exhibit one or more cusps.

How to know a mollusk

Just as fingerprints distinguish individual persons, or the fine cuticular scales of hairs identify species of mammals, so shall you know a mollusk by his radula. The average specimen is so elaborate in arrangement of parts that an almost infinite variation is possible, and whenever Nature has provided a setup of this sort, man has always come along with big words compounded from Greek roots to mark out a classification scheme. The radulas of chitons, tusk shells, and cephalopods are all interesting, but it is especially in the vast class of snails, the Gastropoda, that the number of teeth, their sculpturing, and arrangement have run through a riot of variability, and thereby hangs part of the charm of the study, and the possibility of a taxonomic collection of slides that make a most beautiful series of objects under the microscope.

The teeth occur in both longitudinal and transverse rows, as may be seen in the accompanying illustrations. Typically there is a single *central* tooth in each transverse row, and on each side of this, one or more *laterals*, and beyond these one or more *marginals*. Cooke gives some interesting figures as to numbers, together with a great many pattern diagrams in Vol. III of *The Cambridge Natural History*. In *Chaetoderma* there is the extreme condition of but a single tooth. In a few genera the number is small: *Aeolis* 17, *Elysia* 19, *Glaucus* 21, *Fiona* 28. But these are exceptional on the low side. The common whelk, *Buccinum undatum*, has 220-250, the periwinkle about 3500. *Helix aspersa* has some 15,000, or at the rate of 400,000 to the square inch. But the genus *Umbrella* far exceeds all others, baffling all calculation says Cooke, possibly in the neighborhood of 750,000!

In some, as *Philine*, the centrals are lacking; in *Lymnaea* the centrals are unicuspid; in *Planorbis* they are tricuspid; and so it goes with other rows, too. In the nudibranch family Hermaeidae there is a single row of strong teeth. Almost any conceivable variation can be found, the result of mutations that have led to queer adaptations indeed. In the type illustrated, the radula is nearly as broad as long, with approximately uniform teeth. *Testacella*, the earthworm hound, is a slug that we should not like to meet were we in fact what our wife often avers—a worm. For this pulmonate land form pursues earthworms underground and seizes them with its radula by everting the whole buccal mass to form a proboscis. The long, thorn-like, recurved teeth of the radula seal the doom of the hapless *Lumbricus*. Since the locomotion of a snail is the classical symbol of inertia, the picture of one *pursuing* anything is like unto the celebrated vision of the dog with wax legs chasing an asbestos cat through the infernal regions—but those who have watched these gory proceedings are adamant in regard to the truth of the facts as stated.

But you have not learned a thing yet concerning the radula. One of the huge Orders of snails is the Prosobranchiata, including some terrestrial forms but mostly the better known marine species. Here we have seven Divisions recognized on the basis of characteristics of the radula. Most primitive is the *Docoglossa* (beam-tongue), the limpets; some of these have the unusual condition of two centrals in each row and with the whole radula very long. The *Rhipidoglossa* (fan-tongue) also have a long radula, with long and hook-like teeth, the marginals being indefinitely numerous, uncountable, and diminishing in size laterally. Here occur the keyhole-limpets, abalones, top shells, turbos, and neritas. The *Ptenoglossa* (feathered-tongue) contains only two families, and in one of these a principal genus, *Ianthina*, has a very large radula in two parts, with a trough between them representing the place the missing central teeth formerly occupied. Each tooth is progressively larger from center to margin. The spiral staircases or wentletraps are also members of this group. Wentletraps. There's a word we had not encountered in some years, and our monkey mind got busy on the proposition that, if the shell is a wentletrap, what is a wentle?

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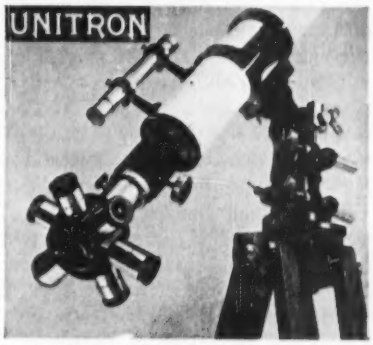

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But alas for our anticipated pleasure in chasing this elusive prey through dictionary after dictionary. There is no wentle! The whole word simply means spiral staircase in Danish.

No radula in pyramid shells

In the *Gymnoglossa* (naked-tongue) there is no radula. The pyramid shells, as examples, have a long retractile proboscis. Many species in this group are parasitic and suck the juices of their host. The *Taenioglossa* (ribbon-tongue) are well-named, the radula being very long and narrow. It is armed with seven teeth in each transverse row; 1 central, 1 lateral on each side, and 2 marginals on each side. In this large group there are *Natica*, the sand collar mollusks; *Crucibulum*, the cup-and-saucer limpets; *Crepidula*, the boat shells; *Littorina*, the periwinkles, with a radula two or three times the length of the animal; *Turritella; Vermetus;* the giant conchs; scorpion shells; the cowries; helmet shells; and a great many others. The oyster drill (*Urosalpinx*), *Murex* (rock shells), *Nassa* (dog whelks), *Buccinum* (whelks), *Busycon*, mitre, olive, and harp shells are representatives of the *Rachiglossa* (spine-tongue), in which the radula is armed with three longitudinal rows of teeth, one central, and one lateral on each side. These teeth are generally multicuspidate and complex.

Seventh and last is that strange assemblage, the *Toxoglossa* (bow-tongue), containing the spires, cones and some others. These are carnivores and their radular teeth are reduced to two rows of marginals, the centrals and laterals being missing; but their absence is more than made up for by the marginals present, as these are long fangs, barbed or hooked, and provided each with a slender poison duct leading from a large poison gland in the proboscis. It is claimed that a bite from some of the cone shells is both painful and dangerous, even to so large an animal as man. Strange indeed, is it not, that even the snail people have their vipers?

The oyster drill, dog whelk and some others use the radula to bore a neat, round hole through the shell of a bivalve, insert the proboscis, and suck out the living tissues of their prey. They do an immense amount of damage in commercial oyster beds. *Pterotrachea*, of the Heteropoda, is a pelagic species of the open sea that swims on its back; it seizes worms and other small animals with its radula and swallows them entire. The nudibranch *Hermaea*, on the other hand, with only a single sharp tooth in each row, feeds on green alage. Remarkable are the forms taken by this highly adaptable organ and the wondrous uses to which it is put. No wonder that zoologists have long been interested in the radula.

Preparation of slides is easy. In the case of larger mollusks, dissect the head from the upper surface, exposing the radula in the floor of the mouth cavity. Remove and place in 10% potassium hydroxide for 24 to 48 hours, or until clean. The interesting, venomous cones have no basement membrane, so potash with great care or the single teeth will fall out. With smaller animals, cut off the head and soak this in the potash so as to recover the radula; if very small, do this work on a slide, use dissecting needles, and isolate the radula under magnification. In all cases, follow the potashing with a thorough rinsing in water for several changes during several hours, or in a gently running stream of water for 2-3 hours. Unless the radula is minute, the next step should be to flatten this structure between two slides to prevent curling during dehydration. On each side of the radula place a strip of something that will correspond with its thickness—thread, string, cord, paper, rubber band—then fasten the two slides together with string or rubber bands and pass through alcohols and xylene. When finished, remove one slide and the props.

If balsam is to be the mountant, many technicians prefer to tint the radula lightly with such a dye as eosin or fast green, since the unstained object will generally be too transparent in this medium. If a color is objected to as unnatural, mount in glycerin jelly. Use coverglass props or a cell mount, as dictated by the thickness of the radula.

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The Yale-SS-4 is a binocular microscope, with the same equipment as listed above, except that the condenser is an aplanat 1.40 and the fine adjustment is of the new low type. A monocular body with graduated drawtube is included, for photomicrography. This is a heavy-duty, strongly built microscope of superb appearance that sells for $350.00.

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Author of An Introduction to Birds, An Introduction to Trees and An Introduction to Wild Flowers, his amazing fund of knowledge has delighted millions on radio and TV

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"NOTHING is more rewarding," says John Kieran, "than the study of nature in bringing parents and children together in a relaxed yet studious atmosphere. The National Audubon Society's new Nature Program combines good fun and entertainment with sound information. The full-color pictures are well chosen and well reproduced — the text is informative — and the subjects amount to an excellent basic nature library. I've tried out the Nature Program on my grandchildren — they love it!"

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Each month a fascinating new topic is selected and a set of about 30 color prints is issued, together with an album in which to mount them and a text that explains your "Museum-at-Home" exhibits. As a *demonstration*, you may have the current set "CAMOUFLAGE IN NATURE" *plus* the illustrated handbook "FUN WITH BIRDS" as an ABSOLUTELY FREE gift package. Send coupon now.

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THE AUDUBON NATURE PROGRAM, Dept. NM-11, Garden City, N. Y.

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